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World War I Trench Warfare (1)

1914–16

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French infantryman, November 1915, still awaiting issue of the 'horizon-blue' uniform ordered the previous autumn; judging from his age he may be a reservist. The red képi is hidden by a low visibility cover of 'mechanics' blue' cloth; the red trousers have been replaced with corduroy, probably brown but possibly blue or grey, confined with long puttees. The dark grey/blue M1877 greatcoat is still worn, with M1888/92 leather belt and brace equipment incorporating three cartridge pouches each carrying three to five 8-round packets for the 8mm Lebel M1886/93 rifle – a total of between 88 and 120 rounds per man. The Lebel's 20.5in-long cruciform 'needle' bayonet looked frightening, but broke easily.

TRENCH WARFARE (1) 1914–16

THE GREAT WAR

THOUGH THE GREAT WAR is rightly remembered as one of the costliest conflicts of history, much of it fought over a comparatively narrow and bloody swathe of France and Flanders, the period 1914 to 1918 was as striking for great change and innovation in the military arts. The outbreak of war saw armies march to battle with a common expectation of a quick resolution, decided by rifles, field guns, cavalry, sweeping manoeuvre and fighting spirit. The traditional, professional and relatively simple virtues of personal leadership, élan and skill at arms were expected to carry the day. Four years later strategy, tactics, and the material of war had altered almost beyond recognition: and society itself had changed with them. Campaigns could now be decided by demography, citizen soldiers, technology, and industrial effort: battles, by a combination of rapid long range bombardments, new small unit tactics, automatic weapons, concrete, and tanks. Individual will to succeed, battlecraft, the 'empty battlefield', and the ability to accept casualties had changed the very idea of war, bringing into question the concept of an 'officer class', and prompting many to ask whether this 'Great War' might be the last.

Greatcoated French infantry firing the 8mm Lebel from behind a stone breastwork in training. They wear no knapsacks, but retain the M1892 *musette* or haversack, and the M1877 litre-capacity water canteen of characteristic two-spout shape. During 1915 the two-litre model designed for African campaigning would become general issue on the Western Front; in the new world of trench fighting troops were often cut off from supplies of drinking water.

THE ARMIES IN 1914

From the end of the first decade of the 20th century, arms races, imperial ambitions, complex international alliances, Balkan wars, France's wish for revenge for the humiliations of 1870–71, and – perhaps most importantly – Germany's claim for a 'place in the sun', all conspired to make a major European conflict seem all but inevitable. History seemed to suggest that such a war might be bloody, but mercifully brief. It was generally accepted that non-European conflicts,

such as the American Civil War or the Boer Wars, were unlikely models for a future European war. For this eventuality there were other precedents, such as the Franco-Prussian war of 1870–71, which had lasted barely six months: or the 'Brothers' War' of 1866, in which Prussia had defeated Austria in a mere seven weeks. In the face of this threat of a short campaign most powers – with the possible exception of Britain, protected by her navy and her natural moat – seemed to accept that only preparation for swift and aggressive land warfare on a massive scale could bring security.

Numbers

How many fighting men a nation could field, and how quickly they could mobilise, were vital factors in 1914. France, with a roughly static population of 39 million, had a standing army of about 700,000: this could immediately be increased to 1,150,000. Reserves and Territorials would bring the total to 4,200,000; but to maintain such a high proportion of her manpower under arms for anything but a short period would be difficult. The Germans had 840,000 troops before the war, but a larger population and swift mobilisation over good rail links could put more than 5,000,000 into the field, with scope for some further increase. Austria-Hungary's pre-war strength was only 415,000, but could be much expanded – though she was hampered not only by the polyglot nature of her army, but by the enmity of her smaller Serb neighbour, and her uncertain relations with Italy. By contrast with Austria, Russia's potential strength was almost limitless, yet her peacetime army numbered 1,300,000, and the time she was expected to need before she could bring her 'steamroller' into action was of critical concern to the planners. Britain had never fielded a mass army, and her immediate contribution would be less significant than that of Belgium; the fighting strength of the British Expeditionary Force in August 1914 would be less than 90,000 men. In a longer war it would remain to be seen whether her industry, financial resources and Empire could be translated into an armed strength comparable with that of the Continental powers.

The armies of Europe were acknowledged for their diverse national characters and strengths: the Austrians, for their super-heavy Skoda siege artillery; the French, for their dash; the Russians, for their numbers and doggedness; the British, for their discipline and steadiness and their skilled musketry. Yet there were many underlying similarities in structure and purpose. The fighting component of all the European armies was divided into artillery, infantry, and cavalry, and though there were differences in detail and quality, the main technological developments and tactical doctrines were common to all.

British recruits for Kitchener's 'New Armies' at Aldershot in 1914, wearing re-issued full dress uniforms without badges and carrying Long Lee Enfield rifles. Many men who volunteered at the outbreak of war would not be committed to action until 1915 or 1916. Training and equipment took time, and some British politicians hoped that the drastic step of commitment to all-out war could be avoided.

Artillery was universally divided into field and heavy – the latter also termed 'foot' or 'siege' artillery. 'Quick firers', capable of rapid accurate fire, equipped the field batteries. The model for many modern field pieces was the M1897 French 75mm, which used 'fixed' ammunition in a brass case, and had hydraulic buffers to absorb recoil. Each French field battery was led by a lieutenant and comprised four such guns. Each gun was part of a section with its own ammunition wagon, six gunners, six drivers, a corporal, and a sergeant in charge. As Gunner Paul Lintier put it, each section 'lived the same life... a microcosm, with its own friendships, antipathies, and habits'. The French fighting *batterie de tir* was supported by its *échelon de combat*, which contained the support wagons, stores, and mobile forge.

The field guns of most armies fired shells of less than 10kg (22lbs) weight, predominantly over open sights – i.e. by direct, observed fire – in immediate support of troops in battle. Metal gun shields provided some protection for the crews against small arms fire. The medium and heavy artillery was intended primarily for siege work, and was comparatively ponderous, but provided a possible antidote to field fortification. Despite this, few armies possessed heavy guns and howitzers for delivering indirect fire in any quantity. Some of the best were the various types of German 15cm schwere Feld-Haubitze, the 1913 model of which was capable of 9,000m (5.6 miles) range. The Germans had the highest proportion of guns, with more than six pieces per thousand infantry – marginally higher than the French and Russians, and roughly double the concentration fielded by their Austrian allies.

The **cavalry** was no longer contemplated as a battle-winning weapon, but was widely assumed to have an important role in reconnaissance, in skirmish actions, in pursuit of a beaten enemy, and as a tool to exploit gaps and breakthroughs in the enemy line. Cavalry were universally trained in the dismounted use of rifles and carbines; even so, the British manual of 1907 stated that the firearm had not replaced the 'magnetism of the charge' and the 'terror of cold steel'. Sabres were still carried by most cavalry, and lances by many; German mounted troops were issued with them whatever their precise designation, leading their enemies to assume that 'Ulans' were present at almost every engagement early in the war. Perhaps those who maintained the greatest faith in horses were the Russians, with their relatively ill-developed rail infrastructure. Just prior to the war more than ten per cent of the fighting troops of the Russian army were mounted, and the mobilised strength of the Cossacks alone was 939 squadrons – almost 140,000 men.

Yet it was the **infantry** which was the most numerous arm, and was expected to decide the issue of battle. As German

Loading the German 15cm schwere Feld-Haubitze. Several of the crew wear the artillery *Kugelhelm* or 'ball' helmet with covers, and one (second right) the greatcoat with coloured collar patches – *Mantelpatten*.

Field Regulations observed, 'In tandem with artillery its fire will batter the enemy. It alone breaks his last resistance. It carries the brunt of combat and makes the greatest sacrifices. Consequently it garners the greatest glory. Infantry must nurture its intrinsic drive to attack aggressively. Its actions must be dominated by one thought: forward against the enemy, cost what it may!'

Accordingly, though many nations also fielded large formations of cavalry, it was the infantry division which was the building block of armies. General officers directed the movements of divisions and brigades, which were composed of regiments and battalions. Divisions were commonly of a dozen or more battalions, with a total strength of between 8,000 and 16,000 rifles. Typical regular divisional organisations of 1914 included:

Austria-Hungary:	12–16 battalions, in two brigades (12,000–16,000 rifles)
Belgium:	18 bns, in three bdes (c.18,000 rifles)
Britain:	12 bns, in three bdes (c.12,000 rifles)
France:	12 bns, in two bdes (c.12,000 rifles)
Germany:	12 or 13 bns, in two bdes (c.12,000 rifles)
Russia:	16 bns, in two bdes (c.16,000 rifles)
Serbia:	16 bns, in four regts (c.16,500 rifles)
Turkey:	10 bns, in three regts (c.8,000 rifles)

Most nations divided battalions into four companies, an exception being the Turks with three companies per battalion. Though there were smaller subdivisions, useful for administration and training, the company, with a full strength of roughly 250 men, was the smallest unit expected to have any tactical significance.

The individual infantryman was the pawn of the battlefield, whose perceived value was to carry his rifle over long distances, react reliably and predictably to orders from his officers, to shoot, and if necessary close with the enemy to decide the outcome with butt and bayonet. The British *Infantry Training* manual of 1914 stated that the objective of training was to make the soldier better 'mentally and physically' than his adversary – the essentials being to develop 'soldierly spirit', a trained body, and facility with 'rifle, bayonet, and spade'. Drill in close order was used to produce cohesion, discipline and obedience to orders.

Perhaps the biggest single difference between the armies was in their method of recruitment. On the Continent conscripted armies, composed of a sizeable percentage of all men in a certain age group, had been the norm for many years. Under the French system, as modified in 1913, a man became liable for service in the year following his 19th birthday, and his military responsibilities could continue for at least 21 years thereafter. Three years were spent full time with the active army, whereafter he passed into the Reserve. Although he could then return to a civil occupation, 40 days' training a year were required. After 11 years he would pass from the reserve to the Territorial army, with which he would spend a further seven years with a reduced liability of nine days' training per year. In theory, when war came reserves would take their place in the line with the regulars, while territorials were employed in home garrisons. It was also possible for unmarried men to

The pre-war belt equipments of all armies were found not to hold enough ammunition for men who might be cut off and fighting without resupply for days. Most armies issued extra cloth bandoliers holding 50 or 100 rounds in charger clips; this German diagram shows the use of their *Tragegurte*, which was hung round the neck. Only the weight limited the number of rounds a German infantryman could carry.

The use of stereoscopic binoculars at an observation post of the Prussian Guard heavy artillery. Each German battery had a six-horse 'observation wagon', and the seven-man battery commander's staff included observers and telephonists for the relay of data. 'Observed' fire was the norm in 1914: 'predicted' or map fire techniques were in their infancy, but developed rapidly after 1914.

join the active army voluntarily for four or five years under the *devancement d'appel*; and re-engagements of five, ten, or 15 years were available to officers and NCOs. The German system was somewhat similar in that conscripts from the active army passed into the Reserve after two or three years; thence to the Landwehr; and finally into the Landsturm.

It was Britain which provided the most radical contrast, with a fully professional regular army recruited by voluntary enlistment, and no conscription until 1916. General von Moltke called the British Army 'that perfect thing apart', but it was a perfection in miniature, overwhelmed by the demands of mass warfare. Ex-Regulars provided a small pool of Reservists, and a second line force was provided by the part-time 'Territorial Force', which had been reorganised in 1908. However, massive expansion from 1914 was only achieved by accepting a huge wave of citizen volunteers at the outbreak of war, and marshalling them into 'Kitchener' Service Battalions of the 'New Armies'. These would be neither fully equipped nor trained for many months. The British system was cheap in peacetime, but provided only a very small, if highly trained force in wartime. The Continental system of conscription, though more expensive, offered the benefit of widespread military experience throughout the population, and relatively easy mass mobilisation.

Tactics

The initiative in battle was believed to lie with the attacker, and though schemes varied in detail most nations concurred that successful actions consisted of a series of phases including an advance to contact; fire fight; and conclusive finish, most likely involving the deployment of a strategic reserve and a charge to take the enemy position. The German *Drill Regulations* of 1906, and *Field Service Regulations* of 1908, outlined an ideal plan in which the infantry manoeuvred in columns until within about 1,000 metres of the enemy. Relatively close formation would allow personal voice command by the company commanders and NCOs. With the enemy position under direct observation, the artillery attached to the German brigade would open fire. If the shelling shook the enemy sufficiently the columns could continue to advance; if the enemy remained steady, the attackers would deploy into loose linear formations of smaller units, and bring the enemy under effective fire from about 500 metres. A reserve would be prepared for the final attack on a flank or weak point. Once superiority of fire had been achieved the German force could close with the bayonet.

The French were even more aggressively disposed, having come to the conclusion that their defeat in 1870 was at least in part attributable to lack of offensive spirit. It was also thought that since the attack gave an advantage, and since French forces might be outnumbered, repeated and

Elderly French 155mm guns, 1914. French shortages of modern heavy artillery would take two years to solve, but all combatant armies faced the same problem to a greater or lesser degree. The pre-war armies, planned for wars of manoeuvre, were strong in light field artillery but weak in the heavy 'battering' pieces previously associated only with siege warfare. Static trench warfare involving, in effect, a 'siege' along a front of hundreds of miles had never been envisaged.

vigorous assaults were imperative. Similarly, Russian regulations of 1912 held that 'offensive action is the best method of obtaining our object; only thus can we seize the initiative and force the enemy to do what we wish'. The Russian battalion was supposed to deploy into lines from column at about 2,500m from the enemy, with each battalion advancing on a front of about 1,200 metres. At about 800m the fire fight would commence, perhaps aided by a unit firing in from a flank. When within 50m of the enemy the infantry could charge home, either with the firing line itself, or with a reserve brought up specifically for the purpose.

In the British synthesis it was envisaged that a commander would use part of his force to engage and wear down the enemy, until the 'general reserve' could strike the decisive blow. Fire was important but it was only the means to the end of making 'the advance to close quarters possible'. The forward troops were to advance 'by rushes' if checked by fire, with either the whole line going on as a body or 'by portions of it alternately'. Bugles were to sound the charge as the assault was made. Battalions were to retain 'local reserves' as required. Infantry advances were to be supported by rapid fire from the artillery, though co-ordination was acknowledged to be tricky, and best managed through a variety of means of communication including liaison officers, signals, and runners. Similarly it was admitted that scope for changes of plan during an action was limited, and battalion commanders were enjoined to give clear orders with definite objectives from the outset.

The British company commander was instructed to 'make full use of his horse' in communicating with both nearby companies and his battalion commander. The company would form the firing line, its immediate supports, and possibly provide a 'few scouts' to 'feel the way' for the advance. Platoon commanders were to supervise their men directly, and section commanders to control the fire of their men. As in the German system, British troops were expected to close with the adversary once superiority of fire had been gained, and the impulse to the final advance was often expected to come from the firing line itself. 'The fact that superiority of fire has been obtained will usually be first observed from the firing line; it will be known by the enemy's weakening of fire, and perhaps by the movement of individuals or groups of men from the enemy's position towards the rear. The impulse for the assault must therefore often come from the firing line... On rarer occasions the commander of the attacking force may be in a position to decide that the time has come to force a decision, and may throw in reinforcements from the rear...'

INFANTRY WEAPONS IN 1914

German infantryman, c1915, in full marching order. The field-grey uniform jacket is of wartime manufacture, with simplified cuffs; the *Pickelhaube* spiked helmet has a plain field cover. The knapsack or *Tornister* has the greatcoat and tent section wrapped around it, and is secured by straps both around the shoulders and hooked to the M1909 ammunition pouches on the belt. The rifle is the standard issue Mauser 7.92mm Gewehr 98.

Rifle and bayonet

All the major powers used bolt action rifles, capable of firing ten or more rounds per minute. The majority used pointed, jacketed bullets with smokeless propellants, and were sighted to about 2,000m – though unless large bodies of men shot at large targets, few casualties were likely to be caused at such distances. According to British definitions, 'close range' was anything up to 600 yards; 'effective range' was from 600 to 1,400 yards; 'long range', from 1,400 to 2,000 yards; and 'distant' from 2,000 to 2,800 yards. Though pretty well all riflemen were capable of generating murderous fire at close ranges, the diverse weapons and levels of skill of the combatants did cause variations in effectiveness. British regulars were arguably the best all-rounders, professional soldiers who were taught 'volume' fire, rapid fire, snap shooting and fire from cover as well as simple accuracy. Their efficiency was aided by the 0.303in Short Magazine Lee Enfield, a weapon developed as a universal arm for infantry and cavalry in the wake of the Boer War. Its useful features included a handy length, a bolt which could be manipulated without taking the gun away from the aiming eye, and a ten-round magazine which could be swiftly loaded from five-round chargers from the top. Fifteen rounds a minute was a perfectly feasible rate of fire; speed trials at Hythe actually reached 28 rounds under ideal conditions.

The Germans were well served by their 7.92mm Gewehr 98 Mauser rifle, which had a particularly robust action and good accuracy, though it was somewhat long for confined spaces, and had only a five-round magazine. It was reasonably fast, and the most skilled soldiers achieved up to 12 rounds per minute, despite a long bolt pull; one British test at Hythe achieved 14 rounds per minute. Other Mauser-action rifles were used by Belgium (which used a slightly outdated 1889 model), Serbia and Turkey. Austria-Hungary, Italy and Romania all had Mannlicher rifles, which were effective enough, though perhaps marginally hampered by a five-round clip loading system. Given the advanced rifle technology of France in the later 19th century it is perhaps strange that she should have entered the war still using the 8mm M1886 Lebel; this was good at the time of its introduction, but its eight-round tubular magazine under the barrel, loaded with single rounds, was outdated by 1914. The Lebel was supplemented by more modern Berthier rifles by 1916, but these suffered from a ludicrously small three-round magazine; capacity was later increased to five rounds.

The Russian rifle – officially termed the *'3 liuevaya vintovka obr 1891'* or M1891 'three line' rifle, in reference to an obsolete measurement of calibre – was also known as the Moisin-Nagant after its Belgian and Russian design team. Shorter variants of this 7.62mm weapon were also produced for the cavalry. All featured a five-round box magazine, and most a long, slender socket bayonet which terminated in a screwdriver point. All the powers suffered from rifle shortages as the armies burgeoned: the British trained on obsolete models, and imported from America, before committing its 'New Armies' to action; the Germans took some old models to war, but made up their deficiencies by captures from the Russians, and hugely increased production. The Russians were perhaps the most unfortunate, attempting to unlock the country's vast human resources with inadequately developed industry and distribution. Approximately 4,500,000 Russian rifles were on hand at the outbreak of war, but recruitment and losses in action made it impossible for the Tula arsenal to keep up with demand. Austrian captures and a motley range of imports were seen in widespread use.

All rifles developed considerable power, most being able to cut through a half-inch steel plate at very close range, or a house brick at 200 yards. The human frame was considerably less resistant, but the precise result of a bullet strike was difficult to predict. At moderate range a direct hit could produce a neat hole, little blood and a swift death. Close ranges or tumbling ricochets were a different story: the medical journals recorded exit wounds five inches across, and there were instances of men with shattered heads and spilt brains who took hours to die. Frenchman Marc Bloch recalled facing some 'superb marksmen' who hit three of his company in the head: 'When a bullet hits the skull at a certain angle, it explodes. That was the way L. died. I went to bring him back. Half his face hung like a shutter whose hinges no longer held, and one could see the almost empty cranial box. I covered the horrible wound with my handkerchief. I knew that L. had died without suffering; it was less terrible to see his poor head than, later, to find the photograph of his small sons in his wallet.'

Yet there were also many lucky escapes. Bloch himself was hit in the arm by a round that had 'the decency to exit immediately, merely burning my skin'. Corporal John Lucy of the 2nd Bn, Royal Irish Rifles recorded a man called Muldoon, hit in the head on the Aisne in 1914, who 'slid grinning' to the ground, only to rise again later covered in blood. 'He got back safe, with a peculiar wound, not at all fatal, for the bullet had hit him near the top of the head, and had passed under his scalp and out at the back, without injuring his skull. The curious behaviour of some bullets, as in this case, puzzled us then and afterwards.' On the other side of the line, near Dixmuide, German Ulrich Timm, a former theology student, reported being hit by a bullet that threw him to the ground. He survived; close examination determined that the shot had passed through both legs, a bundle of field post cards, and some books

0.303in Maxim machine gun, Somerset Light Infantry, c1914. Britain had purchased small numbers of the machine guns designed by Hiram S.Maxim as early as 1887, and on the eve of the Great War the scale of issue was two guns per infantry battalion. These water-cooled, tripod-mounted weapons were fed from 250-round fabric belts and were capable of an impressive cyclic rate of 600 rounds per minute, though the practical rate was a good deal less. Heavy, too few in number, and at first unimaginatively employed, British Maxims were progressively replaced by the more modern Vickers gun which had been approved in 1912.

For all but a few specialists bayonets were a universal feature of the soldier's equipment in 1914. It was commonly assumed that the longest blades were the best, giving maximum 'reach' in bayonet fighting. The slender blade of the original Seitengewehr 98, issued with the German G98 rifle, was 52cm (20.47ins) long; and though the M1905 bayonet most commonly seen during the war was 37cm (14.5ins) in the blade, it was a broad and intimidating weapon. Pioneers received a version with a saw-back blade for cutting purposes; later in the war these saw-backs were abandoned or ground smooth, since there was a fear that they contravened the Geneva Convention and might lead to men captured carrying them being shot out of hand.

German troops with a captured Russian M1905 Maxim gun. Note the Sokolov wheeled mount, with folding legs which could be swung down to form, with the trail, a tripod – cf Plate H. As with most water-cooled weapons, the hose and can allowed steam generated by water boiling in the barrel jacket to be led off, condensed, and later recycled. Some steam usually escaped, drawing attention to the gun's position.

The British carried the M1907 'sword' bayonet with the SMLE, with a blade 43cm (17ins) in length. *Infantry Training* certainly took its use seriously: 'A bayonet charge will normally be delivered in lines, possibly many deep, against a defending force also in lines, over rough ground .. Single combat will therefore be the exception, while fighting in the mass will be the rule... In a bayonet fight the impetus of the charging line gives it moral and physical advantages over the stationary line. Infantry on the defensive should, therefore, always be ready to meet a bayonet charge with a counter-charge, if their fire fails to stop the assailant.'

Such counter-charges were not, however, to be launched prematurely, since a charging enemy actually offered a very vulnerable target to the defenders' fire as he moved in the open, unable to take aimed shots during the rush forward. British trainees were taught not only to rush at dummies, but to parry, jab with the rifle butt, and trip the enemy to the ground. Dummy 'fencing muskets' with telescopic collapsing bayonets were sometimes used for realistic one-to-one training.

Machine guns

Hiram Maxim had designed his famous machine gun in the 1880s but, though it had seen employment in colonial and Far Eastern contexts, it was essentially untried as a battlefield weapon in a major European war. Maxim had referred to one of his early models as a 'World Standard', and though there were differences in detail and nomenclature his boast was not far wrong in 1914. By this time Germany, Britain, Russia, Bulgaria, Romania, Serbia, Turkey and the United States were all using weapons based on the heavy but devastatingly efficient Maxim gun. Typical, and perhaps most important of these Maxim weapons was the German MG08. This gun, developed from an earlier 1901 model, was a belt-fed,

water-cooled, fully automatic weapon based on the Maxim 'toggle lock' system. After cocking and firing the first shot the mechanism would continue to operate as long as the trigger was pressed. Fed from 250-round belts, its cyclic rate was about 400 rounds a minute, though it was more economical and less prone to overheating when fired in shorter bursts. Its basic mount was the Schlitten or 'sledge', a steady, versatile but heavy platform. Carried on the march in carts, the gun and mount could be moved like a stretcher on the battlefield, dragged, or dismounted and carried over the shoulders. The main nations not having Maxim system guns were France and Austria. The former used the air-cooled Hotchkiss, fed with rigid metal strips; though marginally lighter, this was not as efficient as the MG08 in sustained fire. The Austrians used the Schwarzlose, a robust water-cooled weapon with a relatively short barrel, but somewhat similar performance to the Maxim's.

In defence the various models of machine gun were potentially murderous, especially when dug in and arranged to fire over preregistered, enfilading 'beaten zones'. However, machine guns were available in relatively small numbers in 1914: the British and a number of other nations allowed only two per infantry battalion, while the Germans provided a company of six per three-battalion regiment. The Germans had marginally more machine guns proportionately, since each Jäger 'light infantry' battalion also had a machine gun company. Tactics for the aggressive use of machine guns were as yet poorly developed. They were carried forward with advancing troops, but their weight and relative tactical immobility made them less effective in this role.

As British instructions pointed out, the big advantages of the machine gun in 1914 were its high volume of concentrated fire (thought to equal that of about 30 riflemen), its small frontage and relative ease of concealment. At various ranges, 'beaten zones' could be created from 50 to 150 yards in depth. Conversely, the machine gun was 'defenceless when on the move', used large amounts of ammunition, and was prone to temporary stoppages. For these reasons the machine gun could be regarded as a 'powerful auxiliary to infantry', a weapon of opportunity suitable for surprise effect, or as a mobile reserve of fire to be moved up by wagon.

Under the British system machine guns provided close supporting fire for an attack and were then to be moved up rapidly once the ground was won by the infantry. The machine gun section was accounted part of the battalion headquarters, and though the entire personnel of the section were trained to fire the gun a crew of two usually fired it in action. The gun was carried to the desired position in two

German officers with an MG08 in an Eastern Front trench, 1915. In 1914 a German report recommended that all machine guns should be fitted with barrel jacket armour (see Plate D), and also with a lower plate for the front of the sledge mount, and a large (44in x 26in) crew shield with protected vision ports. These larger components seem to have been rare, in practice; but the gun illustrated is fitted with the crew shield, which has been dug in and partly covered with a *Zeltbahn* – the German soldier's combination tent section/groundsheet/rain cape. Note also the periscope at the left of the shield.

parts, barrel and tripod, and re-assembled on the command 'Mount Gun'. On the command 'Load' the starter tag of an ammunition belt was put into the breech mechanism, which was cocked to load the first round. The 'Number One' took his position behind the spade grips, the 'Number Two' by the belt box. Weapons were usually used to give 'rapid fire' in a series of 30- to 50-round bursts on concentrated areas; or 'traversing fire', in which five- or ten-shot bursts were distributed along linear target areas.

THE BATTLES OF THE FRONTIERS

The now-infamous 'Schlieffen Plan' – the basics of which had been drawn up by Field Marshal Count von Schlieffen, the German Chief of Staff, long before the outbreak of war – was arguably the best that Imperial Germany could have adopted in the event of a general conflict. Yet Schlieffen's plan was born of desperation, and helped to usher in the very disaster which it was intended to avoid: all-out war on two fronts.

On the diplomatic map Germany was encircled by Britain, France and Russia, united by pacts of mutual defence; her only really dependable friend was Austria. Against such a background it appeared that the only way in which a war could be won was by a massive pre-emptive strike against one of Germany's principal antagonists. Russia was a vast and unpredictable battlefield; with her primitive infrastructure she also seemed likely to be slow to mobilise. France appeared to offer the greater threat, as the best able to mobilise quickly. It was therefore against France that Germany would throw the bulk of her force: seven armies, committed to a vast concentric wheeling movement or 'right hook' from the north-east, which would ignore Belgian neutrality to push west and then south around Paris, repeating the glories of 1870. The daring part was the risk of leaving just one German army – the Eighth – facing Russia in the east.

Following the assassination of Archduke Franz Ferdinand at Sarajevo, Austria went to war with Serbia on 28 July 1914. As Russia was mobilising Germany followed suit, declaring war on Russia on 1 August. With the Schlieffen Plan now dictating her actions, Germany also declared war on France, the first of her troops entering Belgium on 4 August; and this violation of neutrality was the trigger which brought Britain into the war on the side of her French ally.

Germany had amassed about 1,500,000 men on the Western Front. It was the three armies under Gens. von Kluck, von Bülow

The Kaiser and his generals. Note at right Von Hindenburg, Ludendorff and Francois, victors of Tannenberg; and at left, Von Falkenhayn, Von Kluck and Crown Prince Wilhelm.

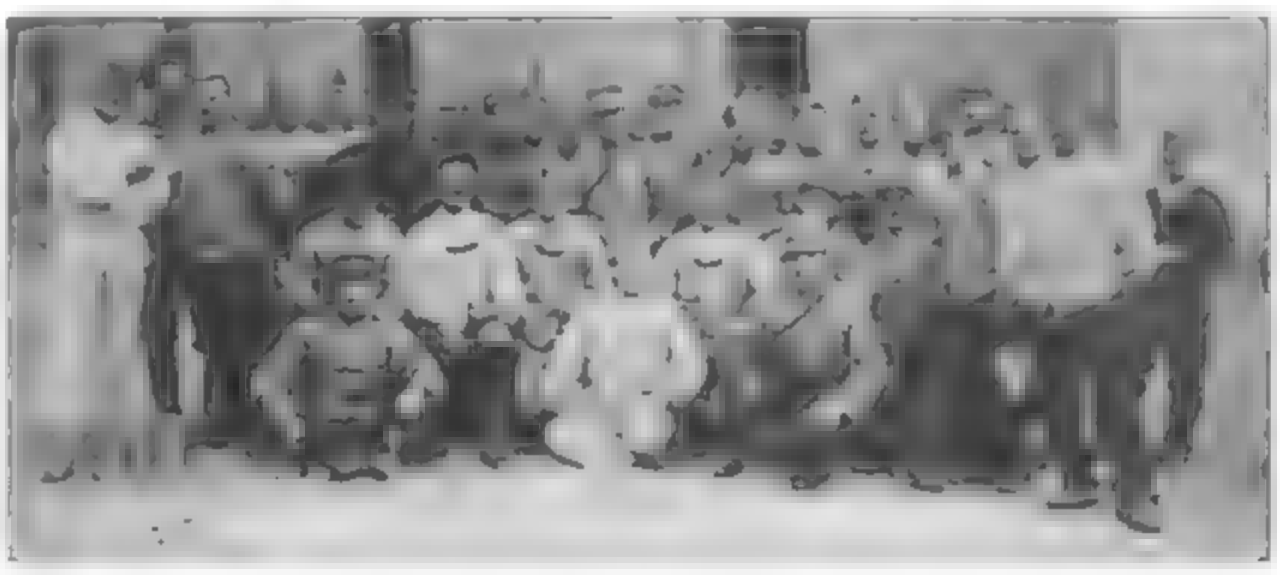
A staged picture of Belgian Carabiniers in defence, 1914. Belgium's knife-edge survival was a result both of assistance from the Entente powers and her own dogged resistance. Antique finery like the Tyrolean hat of the Carabiniers soon disappeared, but the Mauser M1889 rifle proved effective enough.

and von Hausen on the northern flank which were committed to the longest swing through Belgium, with the intention of encircling Paris. Yet 'plucky little Belgium', which had been expected to collapse without a fight, manned her forts at Liége and Namur. Six German brigades under Gen. von Emmich were deployed to crush resistance at Liége, but the result was unexpected. As one Belgian officer described the carnage, 'They made no effort at deploying but came on line after line, almost shoulder to shoulder, until as we shot them down the fallen were heaped on top of each other in an awful barricade of dead and wounded that threatened to mask our guns'. On the afternoon of 6 August Gen. Ludendorff's 14th Bde managed to penetrate between the ring of forts, but none were taken. The Germans were forced to bring up their 42cm Krupp siege guns; only on 16 August did the last of the forts fall, the wounded Belgian Gen. Leman having bought valuable time for the Allies. (It has been conclusively proved that the reported widespread German atrocities in Belgium – once dismissed as propaganda – did indeed take place, apparently prompted in part by frustration over these delays and casualties.)

Men of the French 11eme Hussards, c1914. The French light cavalry had a reputation for dash; the Hussars, along with the Chasseurs à cheval, provided corps and divisional reconnaissance and screening troops as well as separate cavalry brigades. The hussar uniform included a light blue jacket with white braid and shoulder knots; many of these men wear the red-topped képi or pale blue forage cap – *bonnet de police* – with plain stable vests or off-white linen fatigue dress.

While the Schlieffen Plan made much slower progress than expected, French offensive operations, as outlined in 'Plan 17', were soon to degenerate into farce. Mesmerised by the lost province of Alsace, France concentrated her efforts in an attack by her Third, Fourth and Fifth Armies eastwards from Verdun. Beginning the advance on 7 August, the French entered Mulhouse the next day; but on the 10th, after fierce fighting, the town was lost again. The offensive soon ground to a halt.

In the north the 'revolving door' now swung decisively, as the German First and Second Armies smashed into the little British Expeditionary Force at Mons on 23 August. As one 16-year-old eyewitness reported, the Germans walked into a wall of fire. 'The rifles blazed, but the Germans still came on. They were getting nearer and nearer and for the first time I began to feel rather anxious... They weren't an indeterminate mass any more – you could actually pick out details, see them as individual men... *Ten rounds rapid!* And the chaps opened up – and the Germans just fell down like logs. I've never seen anything like it.' Despite the losses on both sides, weight of numbers was soon pushing the BEF back into the now famous retreat from Mons



According to Marshal Joffre's memoir of the Marne fighting, he had decided as early as 25 August that the French First and Second Armies would remain in Lorraine while the centre and left pivoted back on Verdun, with Third, Fourth, Ninth and Fifth Armies and the BEF fighting to halt the German advance. Behind the British a further French army, the Sixth, would be assembled to cover Paris and, if possible, to manoeuvre to outflank the enemy. In an extraordinary twist, Gen. von Kluck now took an apparent opportunity to strike to the left of the French Fifth Army, but this led to his army wheeling south short of Paris rather than encircling it as had been intended. On 2 September orders from Gen. von Moltke confirmed this direction, envisioning that the main body of the French armies would thus be cut off from Paris. By 5 September the battle had been joined along a frontage of over 100 miles. That day Joffre issued his injunction that 'every effort must be made to drive back the enemy. A soldier who can no longer advance must guard the territory held, no matter what the cost. He must be killed in his tracks rather than fall back.'

'Campaign in Belgium and Russia 1914' – studio portrait of German veterans of the first campaigns, winter 1914. The NCO at left displays the *Schützenschnur* or marksman's lanyard, and a recently awarded Iron Cross 2nd Class from a buttonhole. Since he is not wearing his pack a 'bread bag' (haversack) strap is rigged to help support his belt equipment. The *Gefreiter* (note collar button) at right carries a 98AZ short carbine as issued to communication troops, cyclists, and independent machine gun units as well as the cavalry.

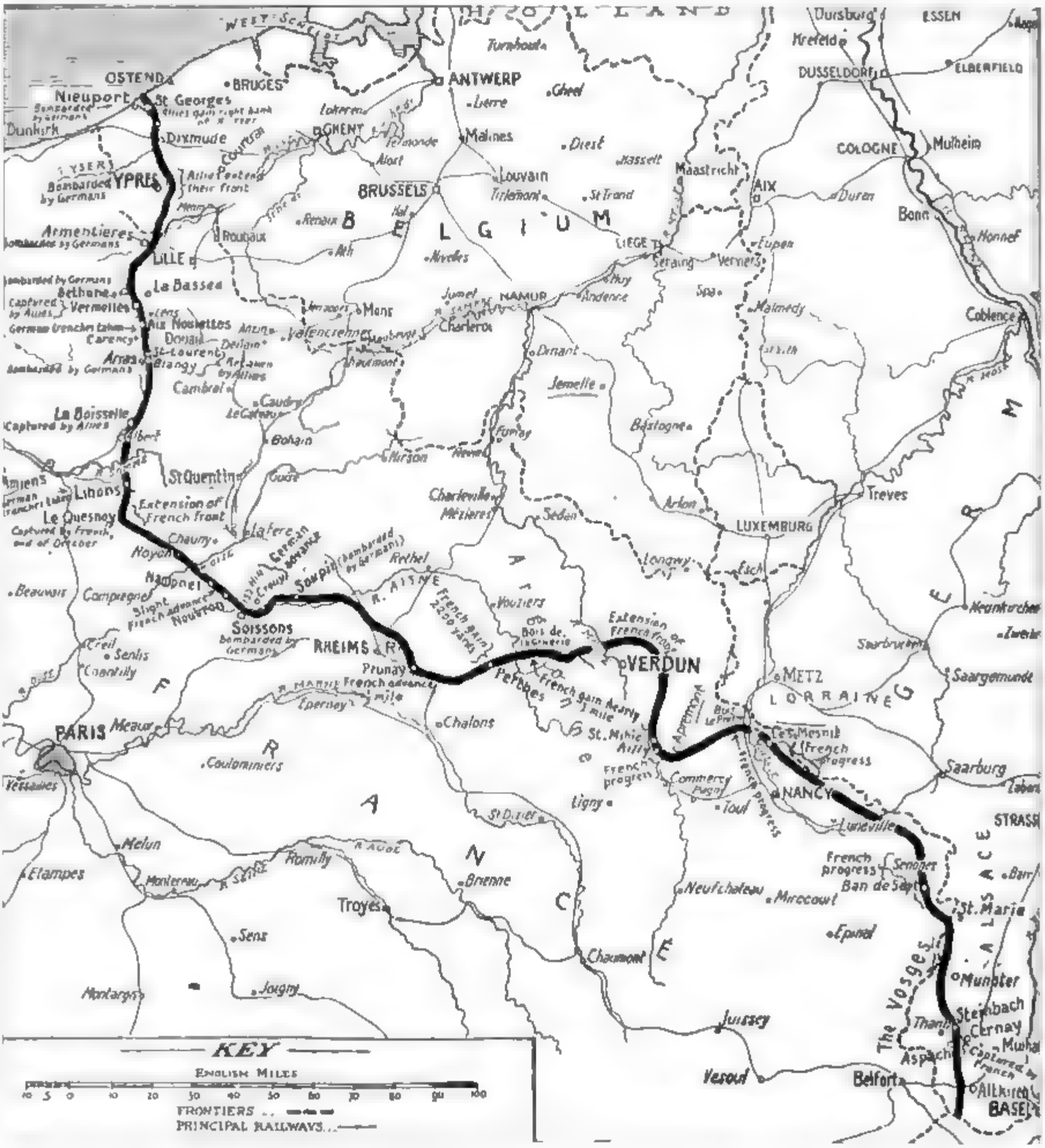
In the experience of French artilleryman Paul Lintier, this was often exactly the result. Distant battle sounded like 'rollers on a pebbly shore', but when a shell hit close the experience was very different: '...A faint noise of wings, an unfolding of some silky material. It grew and swelled into a buzzing of hornets... and then something indescribable – the very air became sonorous, became one great throb, and the throbbing was communicated to our flesh, our nerves, the very marrow of our bones... I was a beast, terrified of death... Crash! The thunderbolt seemed to have fallen at my very feet. The shrapnel bullets whizzed through the air in a great blast of wind.' Soon it was impossible to tell one sound from another. Firing back with the 75mm would be experienced as a vibration of the skull, and a taste, rather than a discernible noise. Battering attacks with artillery and rifle over open sights would cost a total of over 100,000 lives.

The German forces started with at least a local superiority of numbers, but the shifting of the French had tilted the balance until they were actually slightly outnumbered. To make matters worse, Russia had mobilised far more quickly than had been expected and, even as battle was joined on the Marne, vital German reserves had to be sent eastwards rather than to the west. Though Gen. von Prittwitz's failure at Gumbinnen would be more than redressed at Tannenburg by Gen. von Hindenburg by the end of August, this would be too late to allow any last minute changes of disposition in favour of the Western Front.

Employing every means of transport then invented, including the legendary Paris taxi-cabs, the French Sixth Army were now in a position to threaten the enemy's flank. The German advance was halted, and there was no plan to cover such an eventuality. On 9 September attacks were called off and Gen. von Moltke ordered a retreat to the Aisne. Crown Prince Wilhelm blamed Von Moltke squarely for the disaster:

'Military genius was conspicuously absent... The battle was conducted in a wholly mechanical and conventional manner. The resultant trench warfare was the natural outcome of an exhaustion brought about by a failure on both sides to develop a decisive strategy.' The battle of the Marne was followed by the so-called 'race to the sea' which was actually, as Joffre observed, a series of attempts by the German and Allied armies to outflank each other to the north until they came right up against the coast. With the Germans in possession of Ostend, dry land eventually ran out; the war had nowhere to go.

The Western Front, January 1915


OSTEND
BRUGES
ANTWERP
Nieuport
St Georges
Dunkirk
Dixmude
GHENT
YPRES
Armentieres
LILLE
Roubaix
BRUSSELS
Malines
Louvain
Maastricht
AIX
LIEGE
Verviers
Eupen
Duren
Bonn
COLOGNE
Muheim
DUSSELDORF
ELBERFIELD
ESSEN
Duisburg
Krefeld
Turnhout
Ghent
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Tirlemont
St Trond
Namur
Andenne
Malmedy
Coblence
Honnef
La Bassee
Bethune
Vermelles
Aix Noulettes
Carency
Arras
Lens
Mons
Charleroi
Valenciennes
Douai
Cambrai
Bapaume
Albert
La Boisselle
Bohain
St Quentin
Amiens
Lihons
Le Quesnoy
Extension of French front
Chauny
Noyon
Compiegne
Beauvais
Nampel
Soissons
bombarded by Germans
RHEIMS
Prunay
Epernay
Chalons
Coulommiers
Senlis
Creil
Chantilly
PARIS
Meaux
Versailles
Melun
Etampes
Montereau
Romilly
Nogent
Brienne
Troyes
Sens
Montargis
Joigny
Chaumont
Vouziers
Sedan
Charleville
Mezieres
Longwy
Arlon
Treves
LUXEMBURG
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Neunkirchen
Saarbrucken
Saargemunde
Saarburg
METZ
VERDUN
Etain
Commercy
Toul
NANCY
Luneville
STRASS
Senones
Ban de Sapt
St. Marie
Munster
Steinbach
Cernay
Thann
Aspach
Belfort
Altkirch
BASEL
Neufchateau
Mirecourt
Epinal
Jussey
Vesoul
Jemelle
Dinant
Bastogne
Furnay
Marson
Ligny
St Dizier
Romilly
Juvincourt
Bois de Consenvoye
Bois le Pretre
Les Mesnil
Ailly
St. Mihiel
Apremont
Pont a Mousson
Pagny
Fresnes
Combres
Les Eparges
Hattonchatel
Etain
Conflans
Briey
Longuyon
Audun le Roman
Fontoy
Metz
Thionville
Diedenhofen
Sierck
Merzig
Saarlouis
Saarbrucken
Zweibrucken
Landau
Weissenburg
Wissembourg
Hagenau
Strassburg
Colmar
Schlettstadt
Molsheim
Rosheim
Obernai
Selestat
Munchhausen
Wasselonne
Saverne
Zabern
Pfalzburg
Lutzelburg
Phalsbourg
Dieuze
Morhange
Sarrebourg
Chateau Salins
Nancy
Luneville
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Montigny le Roi
Juzennecourt
Chalindrey
Andelot
Bourmont
Joinville
St Dizier
Wassy
Vitry le Francois
Sompuis
Somme Tourbe
Suippes
Souain
Perthes
Tahure
Auberive
Ville sur Tourbe
Massiges
Minaucourt
Le Mesnil
Prosnes
Somme Py
Ste Menehould
Clermont
Varennes
Montfaucon
Dun
Stenay
Sedan
Mezieres
Charleville
Rethel
Attigny
Vouziers
Grandpre
Buzancy
Le Chesne
Machault
Challerange
Monthois
Rethel
Asfeld
Guignicourt
Corbeny
Craonne
Craonnelle
Berry au Bac
Roucy
Pontavert
Bourg et Comin
Neufchatel
Soissons
Fismes
Fere en Tardenois
Chateau Thierry
Dormans
Epernay
Chalons
Vertus
Montmirail
Sezanne
Provins
Nogent
Bray
Romilly
Nogent l'Artaud
Chateau Landon
Montereau
Melun
Fontainebleau
Etampes
Dourdan
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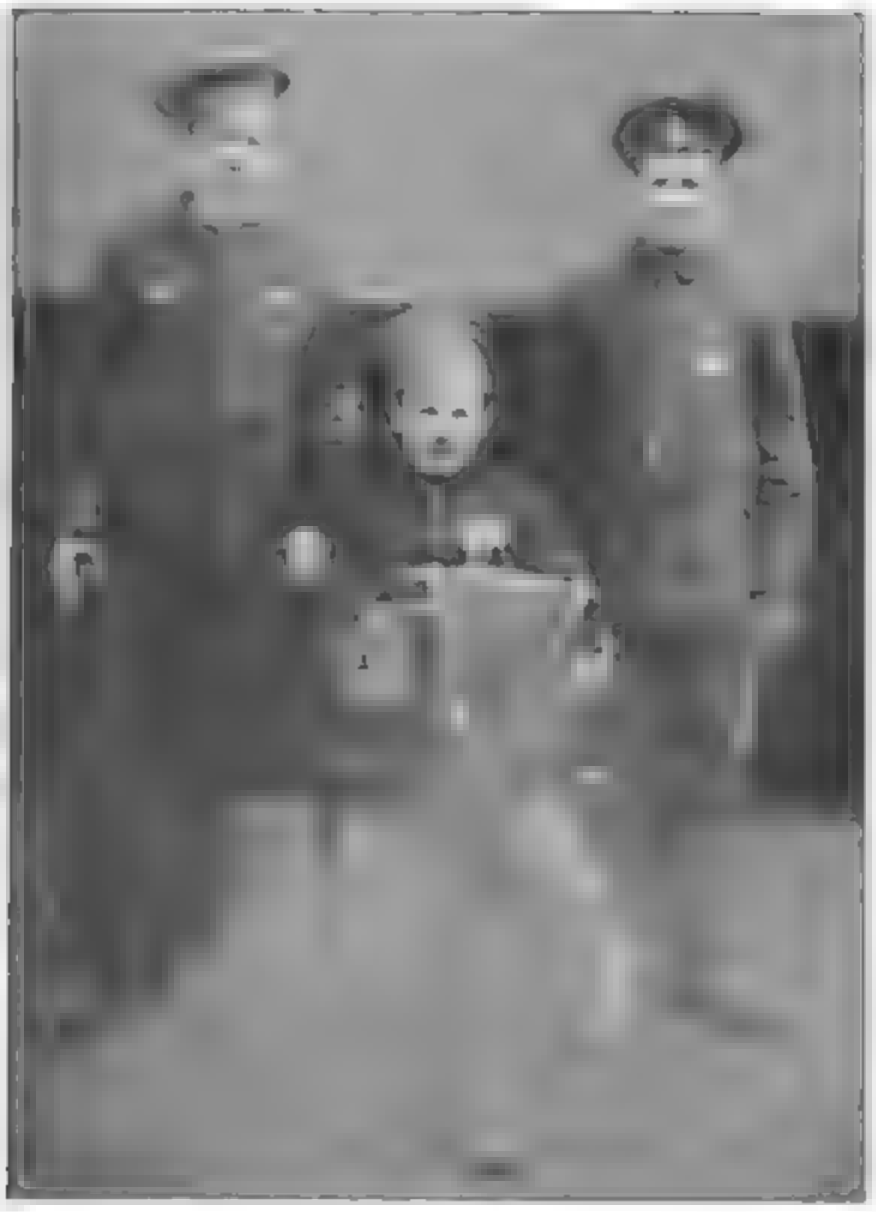


Russian prisoners of war, wearing jackets with identifying numbers and contrasting bands of material cut into the sleeves. About 100,000 Russians were captured at Tannenberg, another 30,000 at the battle of the Masurian Lakes. Though the Russians were more successful against the Austrians in Galicia, more than 40,000 were also taken prisoner there in 1914. According to Prof Norman Stone, the Austrians and Germans went on to capture more than 1,000,000 Russians during 1915.

THE FIRST TRENCHES

Diabolical though they often were, trench systems came into existence for good practical and tactical reasons. The idea of all field works was to protect and hide troops, and the particular conditions which emerged during the latter part of 1914 made trenches a necessity rather than an option. Killing power had developed exponentially. In 1814 a soldier in battle would have been lucky to achieve three musket shots per minute to an effective range of about 100 metres; in 1914 the bolt action rifle made ten aimed rounds per minute at 500m perfectly practical. Taking into the equation the areas swept, as well as speed and accuracy, suggests that each infantryman was now capable of generating ten times the volume of fire of his Napoleonic predecessor. Similar calculations applied to the artillery. In 1814 field guns could not usually be fired more than once a minute, generally used solid shot, and few were of much effect beyond 1,000 metres. By 1914 'quick firer' breech-loading field guns were routinely throwing air-bursting shrapnel rounds, more than ten times a minute, out to more than 5,000 metres.

At the same time the numbers of men and weapons had vastly increased. The German Army had seen the greatest expansion, being ten times the size of the Prussian army of the Napoleonic period; but all armies had grown several-fold. In 1814 armies could cross large areas like Spain or central Europe and in the process evade or outmanoeuvre each other. By 1914 rapid movements were channelled by timetable through a relatively crowded Europe, along rail tracks, while telegraphs, telephones, and balloons gave warning of their approach. Moreover, on the Western Front at least, the forces of the Entente and the Central Powers were too finely balanced to admit of immediate victory. The Germans had greater numbers than the French, but any initial advantage was offset by the two-front war, the resistance of the Belgians, and the small but steadily increasing contribution of the British.

The alternatives in late 1914 were stark: dig in and accept heavy casualties, or stay on the surface indefinitely and be annihilated. As a Canadian writer would put it within a few months of the actual events, 'They had to hide in the mud of the trenches to escape German bullets. It was a choice of mud or death.'

Though it was still presumed that winning would mean attacking, there were precedents for temporary and localised field entrenchments, as had been used in the Russo-Turkish and Russo-Japanese wars. As the British *Manual of Field Engineering* explained: 'By Field Fortification is implied all those measures which may be taken for the defence of positions intended to be only temporarily held. Works of this kind are executed either in the face of the enemy, or in the immediate anticipation of his approach... Field Fortification presupposes a defensive

British Regulars, c1914, in textbook M1902 khaki wool service dress, and M1908 webbing equipment; each of the ten flapped pouches accommodated three 5-round chargers of 0.303in ammunition for the SMLE rifle – 150 rounds in all. Every infantryman was expected to be able to fire at least ten aimed shots per minute, and 15rpm was common for 'rapid fire'. The manufacturing quality of this generation of service rifles was very high; and their weight and length made them accurate over several hundreds of yards in the hands of trained soldiers. In open field fighting a thousand-man battalion could thus generate a murderous volume of fire at normal battle ranges.

attitude, and, though recourse to it may under certain circumstances be desirable, it must always be regarded as a means to an end, and not an end in itself... The principal aim of field fortification is to enable the soldier to use his weapons with the greatest effect, the second to protect him against the adversary's fire. By thus reducing losses and increasing the power of resistance in any part of the theatre of operations or field of battle, more troops will be available to swell the force destined for decisive action there or elsewhere.'

The conundrum of the Great War was that there were so many men, with such effective weapons, so evenly balanced, that there *was* no 'elsewhere'. It has been suggested that the trenches were to become a 'live and let live' system, and in quiet sectors, where exchanges of fire tended to become ritualised, this was sometimes the case. Yet the war was only ever static in a geographic sense: there was a constant tactical, technological, and industrial evolution whereby the trench deadlock would eventually be broken. The war would develop so quickly that a man wounded in 1914 and returning to the front in 1916 would have had difficulty understanding that it was the same war. It was also the case, as Gen. von Falkenhayn would later remark, that as one side developed a weapon to break the defence, the other gained time to employ the latest defensive methods

Digging In

The infantry were universally supplied with entrenching tools to provide their own cover. Typical of many was the French *pelle-bêche*, a short-handled shovel which hung from the belt in a leather carrier. This was supplemented with the small *pioche* or pick, bills, saws, and hand axes, allowing a company to break ground and deal with small trees and foliage as well as dig in. A new *pelle-pioche* had been introduced in 1909, a dual purpose two-piece demountable pick head and handle which was used by a proportion of troops at the outbreak of war. By 1916 a French infantry company was provided with 48 *pelle-bêches*, 56 *pelle-pioches*, 30 short M1916 spades, 32 picks, 8 hand axes, 12 bills, 16 wire cutters, and a folding saw. Long-handled spades and other tools were carried with the baggage and engineers, or provided when specifically required. Short-handled, blunt-ended shovels similar to the *pelle-bêche* were carried by the Germans, Russians, Belgians and Austrians, while the US Army M1910 and cavalry M1912 implements featured a pointed blade.

The British 'implement, intrenching, Pattern 1908' was a dual-purpose tool with separate helve and head which, though not the most efficient digging instrument, was pretty versatile. It saw use not only as pick and shovel, but as a general purpose hook, and was even regarded by some as improvised protection when the metal head was suspended against the

user's body in its webbing carrier. Just how useful digging tools were only really became apparent when they were left behind, as Lt. Hall of the 20th Hussars discovered after crossing the Marne – he spent much of one night 'digging a trench with the aid of a broken plate, mess tins, knives and forks'. Some of his men used their bayonets, others begged spades from civilians.

Improvised cover could be dug fairly quickly, and to give temporary protection for a prone rifleman a scrape 30cm (12ins) deep was just adequate. Edmund Dane's estimate was that a good job could be made within the hour. British troops were taught to work 'lying down, and to commence at the rear of the selected position. Hard soil is more easily broken up by this method and a hollow for the disengaged arm is gradually provided, which helps to keep the digger under cover'. Marc Bloch, serving with the French 272eme Regiment d'Infanterie, saw the Germans use exactly the same method in 1914, burrowing away to create what appeared to be a 'yellowish ramp', leaving only their hands exposed from time to time as they threw earth from their implements. Such scrapes could save a man's life, but were uncomfortable and vulnerable to shrapnel.

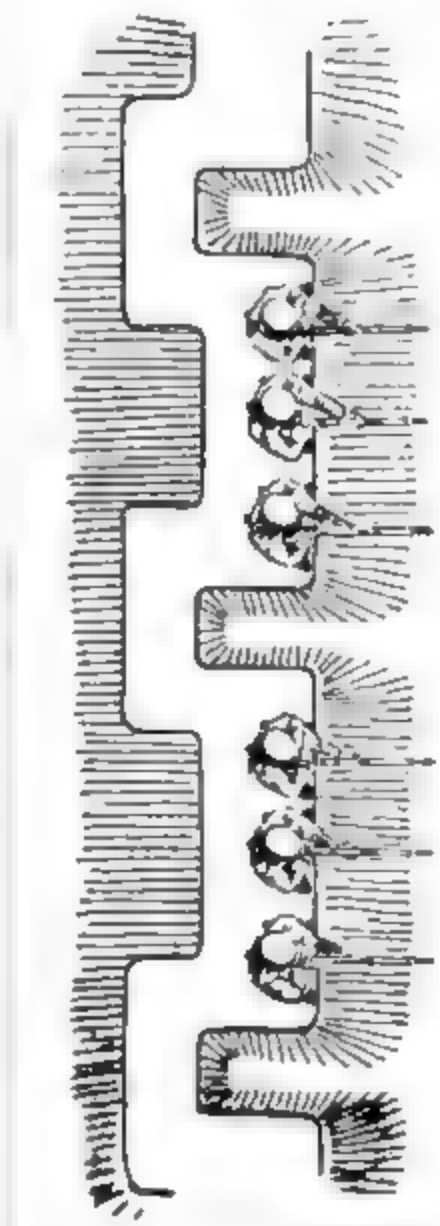
Some advantage could be expected from natural features such as rises or hedge banks and bulletproof objects such as rails or bags of earth, but as F.J.Solano observed in his *Field Entrenchments; Spadework for Riflemen* in 1914, care had to be taken lest items be scattered 'by the impact of bullets and become a source of danger'. French instructions encouraged the use of piles of stones provided that they were at least 30cm in thickness, and covered with earth to prevent fragments flying. Fallen tree trunks were similarly useful, but again were best combined with earth, and fired around rather than over.

Kneeling cover could be made by linking individual scrapes together, but was better done on preplanned lines, using reliefs of troops in a systematic manner. According to the manual a three-foot fire trench of adequate dimension to cover its diggers could be created in a hundred minutes. A standing fire trench would require upwards of five hours, and was likely to require two shifts or a rest period during construction. Sandbags and barbed wire were in very limited supply in 1914, and brushwood, sacks, sods and timber revetments were all used. At least one account records soldiers' packs being filled with earth to give cover. The destruction of crops, and the laying of planks studded with nails and caltraps, both opened up the field of fire and impeded the enemy advance. Soon the battlefield would show little sign of life above the surface: as the Canadian historian would put it, the nearer you came to the front line, 'the more difficult you find it to set eyes on men'.

Pristine *Schutzengraben* – German fire trenches – dug by soldiers wearing white fatigue uniform. Note the timber revetment, fire steps, and traverses designed to limit the effects of blast and enfilade fire.

French manuals placed particular emphasis on the making of fascines and gabions from natural materials. Yet their trenches soon acquired a reputation for slovenliness and poor construction; Robert Graves even observed that bodies were actually buried in the floor of the trenches, thereby making them shallower as the casualties mounted. Some of this was fair criticism, but the

British troops demonstrate the ideal trench-digging method, with traverses marked out with pegs, and sods laid to cover the parapet.



The 'modern fire trench' with bays between traverses, from Edmund Dane's book *Trench Warfare*, 1915.

rather temporary French attitude to trench construction was in part born of unwillingness to admit a permanent enemy presence on their territory, and a natural preference for the offensive. It was also the case that in terms of producing the materials required for thoroughly professional field works the French were worse placed than their allies. A higher proportion of their workforce had already been called up, and the length of their front line was much greater. In late 1914 Marc Bloch was complaining not only that his countrymen were lax in digging, but that building materials were as yet entirely lacking. Ordinary wire of the type used to hang door bells and tram lines was being strung in place of barbed wire.

Text book trench lines were sited, as the British *Notes on Field Defences* put it, to give the maximum field of fire while denying the enemy a clear view of the position. The best form for the excavations themselves was 'deep, narrow, and with low command. The rifle, when resting on the parapet, must sweep the ground immediately in front. . strong traverses should be provided every four yards or so to localise the effect of high explosive shell falling into the trench, and also give protection against enfilade fire.' Such was the ideal, but at times this was impossible. In Flanders in particular the water table was so near the surface that any deep excavation filled with water. Sometimes the only solution was to build 'trenches' upward rather than digging down; parapets were built up above the existing ground level using sandbags and timbers. These were known as 'command' or 'box' trenches, but many units preferred to dig down, stand in water, and risk trench foot, since box trenches took huge labour to construct and were painfully obvious features in the landscape. At Houplines in the winter of 1914 Frank Richards of the Royal Welsh Fusiliers would describe how hand pumps would be worked day and night in a vain attempt to clear knee-deep water. Baling with buckets drew enemy fire – one man so engaged had his thumb shot off.

Overhead cover

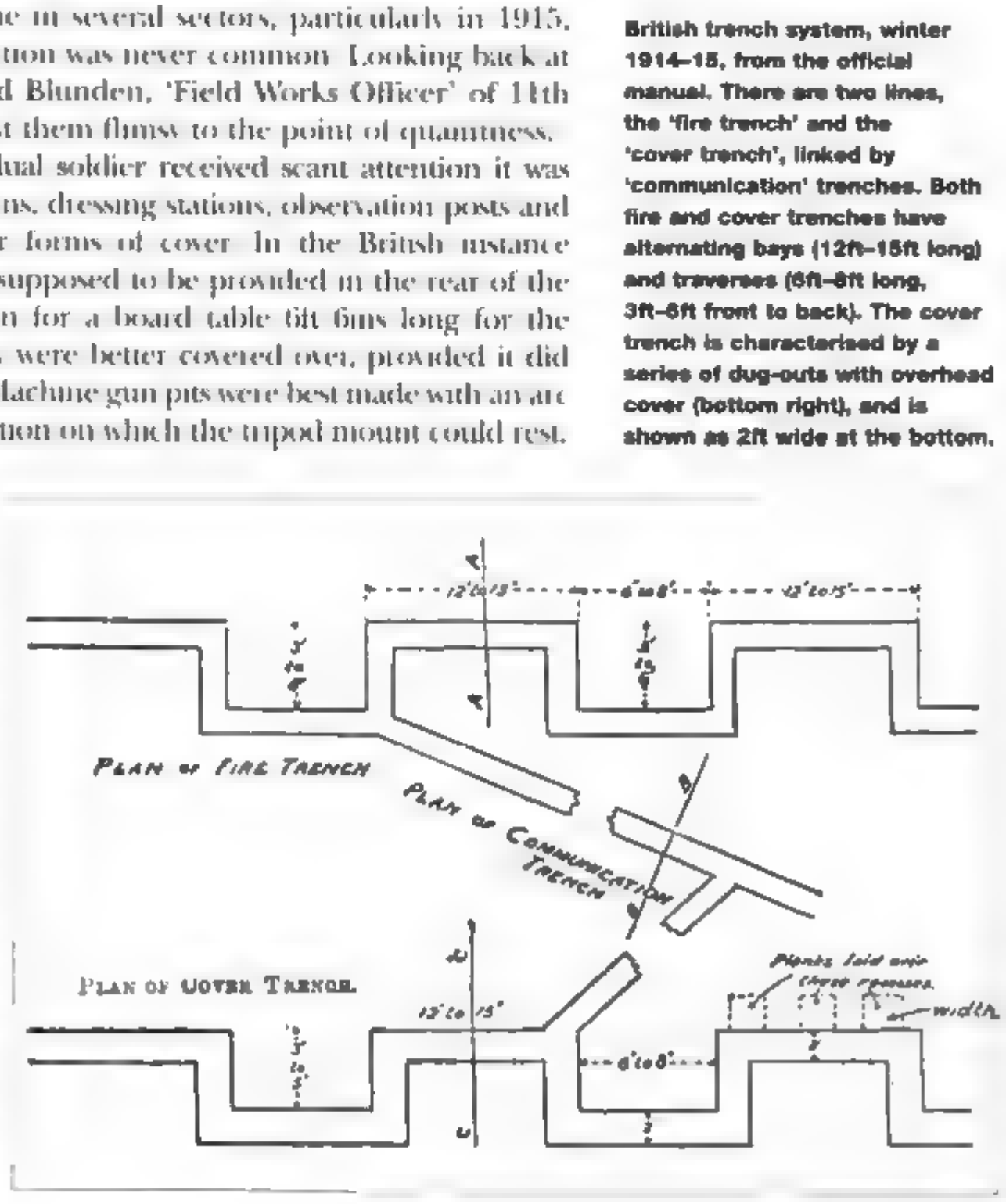
This was rudimentary at first. The pre-war British *Manual of Field Engineering* was of the opinion that it would most likely take too long to construct, and that in any case materials would 'often not be available'. Even so, it guessed that as aviation and shells improved such cover would become more important. To this end it was recommended that protection against shrapnel and grenades be provided using 9ins to 12ins of earth supported on boards or corrugated iron. Similarly it warned that splinterproof shelters should not weaken the parapet, curtail the numbers of rifles available for defence, nor be difficult to get out of quickly. 'Numerous and simple' shelters were declared preferable to a few elaborate ones. In practice many men scraped out individual

cubbyholes under the parapet – the Germans called these 'Stegbred' shelters, and the British, 'funk holes'. They aroused a mixed response from officialdom, since they might collapse and trap the occupants, and tended to leave odd arms and legs sprawling out into the trench to be stumbled over during the constant traffic of men to and fro.

In an incident at Ypres in November 1914 Brig. Gleichen recorded being covered in dirt by exploding shells, and then a dug-out collapsed and broke the legs of two officers of the West Yorkshires. Three Cheshires were buried alive and not rescued, and a dozen others killed or wounded, the result not only of flimsy overhead cover but of the high water table and shallow trenches. The French Sgt. Marc Bloch recalled that in September 1914 his first experience of overhead cover was shelters clumsily made out of branches, skimpy constructions which did not even keep out the rain. Afraid to lie down in the water which had turned the trenches 'into brooks' and wearing only the issue uniform, he spent one entire night standing up, feeling as though he was 'naked in an icy bath'.

Fire trenches could be given overhead cover, and good examples appear in the manuals of various nations; however, unless the roof was propped and loopholes provided the defensive function was seriously undermined. Though in vogue in several sectors, particularly in 1915, this system of overhead protection was never common. Looking back at such early efforts, Lt. Edmund Blunden, 'Field Works Officer' of 11th Bn. Royal Sussex Regt, thought them flimsy to the point of quaintness.

While sheltering the individual soldier received scant attention it was acknowledged that machine guns, dressing stations, observation posts and artillery all required particular forms of cover. In the British instance covered dressing stations were supposed to be provided in the rear of the trench line, including provision for a board table 6ft 6ins long for the patient. Machine guns similarly were better covered over, provided it did not make them more obvious. Machine gun pits were best made with an arc to the front and a shallower section on which the tripod mount could rest.



British trench system, winter 1914–15, from the official manual. There are two lines, the 'fire trench' and the 'cover trench', linked by 'communication' trenches. Both fire and cover trenches have alternating bays (12ft–15ft long) and traverses (6ft–8ft long, 3ft–6ft front to back). The cover trench is characterised by a series of dug-outs with overhead cover (bottom right), and is shown as 2ft wide at the bottom.

Deep cover and multiple positions

The first trenches were seen as protection for front line units *in situ*, rather than as semi-permanent defensive features in their own right. The result was a shallow position with a single line of trenches, or a double line if a support trench was included. (Note that in this text the terms 'deep' and 'shallow' are normally used in the sense of the horizontal arrangement of lines of defence, i.e. more or less extensive from the front to the rear of the

Men of the King's Own (Royal Lancaster Regt) make themselves comfortable; groundsheets and webbing festoon the trench walls, and note the parapet built up with courses of sandbags laid in alternate layers 'side-on' and 'end-on'. The men's headgear includes rolled-up balaclavas, and the 1914 'winter' unstiffened service dress cap with its distinctive flaps – the famous 'Gor-blimey'. (King's Own Collection, Lancaster City Museum)

trench system.) Moreover at this stage of the war attempts were usually made to accommodate whole units in the front line simultaneously. Trenches therefore tended to be crowded and tactically inflexible: the line was either held, or lost. Early German instructions, as Gen. Erich von Falkenhayn recalled, stated that 'the line apportioned to the troops for defence was to be maintained at all costs, and if lost was to be retaken'. It was also widely believed that if troops were given any possibility of 'interpretation' in their orders the likely effect would be surrenders or voluntary retirements. Yet with time came the realisation that deeper defences and less dense manning had signal advantages. Shells caused fewer casualties, reserve lines gave firm bases from which to launch counter-attacks, and multiple lines of field works absorbed the power of an attack, which could be shot at from many directions.

The degree to which trench planning and construction developed in the first 18 months of war is perhaps best illustrated by the German practice, as outlined in the *Manual of Position Warfare, Part 1*, on 'Stellungsbau' or the construction of field positions, 1916. This explicitly stated that it was now 'a ruling principle that ground to be held must be fortified in such a way that an obstinate defence by sectors is obtained, and to such a depth that the loss of or withdrawal from parts of the position does not endanger it as a whole'. Trench systems were to consist of several continuous but not parallel lines 150m–200m apart. Moreover, the first defensive position was to be backed with another, between two and five kilometres in the rear, so that both zones could not be attacked simultaneously. Both areas, and parts of the intervening ground, were to be studded with strongpoints, blockhouses and 'holding points'. Machine gun positions were held to form the 'framework of all infantry fighting lines', and arranged so as to enfilade the ground between zones. Relatively few guns were to be kept in the very front line, and those were to increase their power by mobility.

Mere 'splinterproof' cover was now dismissed as a liability which had a tendency to fall and block trenches. The German system now aimed to provide in the front line 'shellproof' shelters capable of withstanding 'continuous' shelling from guns of up to 150mm calibre, and at selected spots 'bombproofs' capable of taking bombardment from 200mm guns and occasional hits from even heavier pieces. Concrete and reinforced concrete had now begun to make their appearance in shelter construction; not only were they strong, but they had the added advantage that even a relatively shallow dug-out could provide protection; these shallow dug-outs were less likely to flood, and quicker to evacuate.

For the trench parapets themselves the German ideal was now sods or brushwood anchored with pickets. This was a strong and cheap arrangement, and had the advantage that it was unlikely to obstruct the trench if blown in; sandbags were seen as suitable for quick work. Flint, stone, and brick were regarded as objectionable since they fragmented dangerously when hit. Though narrow trenches were admitted to give the best protection, German theory now suggested that they should be relatively deep and broad, with the sides not absolutely vertical. Little revetting was therefore required and men could move quickly along them

Manning the trenches

Though Allied trenches often lacked the apparent permanence of the enemy fortresses, they too offered significant evidence of change. Most nations tried to get men out of the line from time to time, and French accounts speak of a week-on, week-off system in some sectors within a few months of the outbreak of war. The British were soon able to adopt a highly organised policy of rotation in which each brigade put only two of its battalions in the front line, with others further back in 'support' and 'reserve'. Even in the two lead battalions only half the available manpower was actually stationed in the front line trench. Unless a 'big show' was in progress only a very small proportion of the troops were actually in range of the enemy rifles, though more might fall prey to artillery. Systems of rotation entailed much stumbling back and forth by night along cramped communication trenches, burdened with heavy equipment, and a good deal of frustrating paperwork as 'trench stores' were accounted for and handed over; but they improved morale considerably, and allowed training and rest.

E.B.North, the Brigade Major of 124th Bde, went so far as to have *Trench Standing Orders* printed up, bound in card covers, and distributed along with the 'official' War Office publications. These standing orders specified that company and platoon officers of relieving units would visit their new sector, gain information and sign receipts. Machine gunners, bombers, snipers and signallers would arrive a day early, taking up their posts in daylight so as to be familiarised and in position before the rest of the trench garrison. The rest of the men would march up under cover of darkness, extinguishing lights and cigarettes at an agreed point; would make contact with the units on either flank, and exchange posts with the men being relieved at the fire step. Within 24 hours the new company commanders were expected to have submitted a thorough report detailing,

German soldiers trench-digging in the Argonne, 1915. Trench layouts were governed by topography and available materials as well as the official manuals. Although German trenches generally had a well-earned reputation for thoroughness, so far this example is revetted only with a few flimsy brushwood hurdles. (IWM Q45584)

amongst other matters, fields of fire, distances to enemy posts, state of the wire, reserves of ammunition and gas precautions. Nineteen categories of materials were designated 'trench stores' and had to be accounted for. Daily returns were expected at brigade headquarters on weather, casualties, intelligence, and stores required, the first of these to be completed at 5.15am, the last at 9pm; the response of some harassed company officers to these bureaucratic demands may be imagined.

Along with a highly organised routine British planners became particularly keen not only on positions in depth, but on prefabricated dug-out frames made behind the lines, and so-called 'Elephant Shelters'. These were arcs of corrugated iron, sunk into the ground and covered with different layers of materials including concrete, wooden sleepers and soil to create a quick and easy-to-build shellproof shelter. The French adopted a similar device which translated approximately as a 'cover of arched iron', but they also made widespread use of bunkers constructed of logs. Though there was sometimes difficulty in getting compliance in practice the French *Manual of Field Fortification* warned that an infantryman had to be good not only with a rifle but with a spade, and that it was up to commanders to exercise 'unrelaxing care' to ensure that field works were not only completed but kept in good repair. It was also accepted that positions could now be held not only by bodies of men in lines, but by strongpoints in depth. Garrisons did not have to occupy every sector of a trench system simultaneously but could be so arranged as to 'economise on personnel' by using flanking fire.

The 'shell scandals'

As soon as the trench lines were dug it became apparent that the existing ways of waging war were inadequate. Trenches had no flanks, and conferred an almost insuperable advantage on the defender. Alarming French calculations of January 1915 suggested that a rifle-armed trench garrison, with a clear field of fire, would need to be assaulted by 12 times their number to ensure that a roughly equal number of attackers actually reached the enemy trench. Even if successful such a suicidal attack would cost the attackers 11 times the casualties of the defenders. If machine guns were involved it was postulated that the attackers would suffer 14 casualties for every defender, and would probably not reach the trench at all.

OPPOSITE **French fire trench, 1915; troops aim through loopholes in the parapet while standing on an elaborately made wooden fire step. A deeper cover walkway passes behind the step, with a drainage channel running alongside.**

OPPOSITE BELOW ***Ein Gruss aus dem Schützengraben*, 'a greeting from the fire trenches': a postcard sent back to the family Meyer from the Western Front by a member of 10th Ersatz Division, April 1915 (note the non-regulation socks with laced ankle boots). Above the fire step is partial revetting with brushwood; by 1916 this was the recommended method, although trenches on the Eastern Front made more extensive use of**

The immediate consequence was a scramble to procure weapons which could deal with trenches: shells and heavier guns for the artillery, grenades for the infantry. As a bemused Maj Gen. Rawlinson put it in December 1914, 'this trench warfare in which we are now engaged is causing a demand for all sorts of things which are not recognised by regulation'. Most countries promptly suffered a 'shell scandal' – an inability to meet the needs of their guns for ammunition. This was perhaps best documented in Britain, and most catastrophic in Russia. One British diplomat, touring the Eastern Front by bicycle, was moved to reflect the current Russian opinion that the war had become one of 'men against metal'. At Gumbinnen it has been calculated that the Russian guns were being supplied with 214 rounds per day, but firing them at a rate of 440. In September 1914 the Russian high command predicted that it would now require 1,500,000 shells per month, but within weeks this estimate had been revised upwards to 3,500,000. In the first part of 1915 only 500,000 shells a month were actually delivered, and at critical moments Russian batteries would fall silent. The Germans managed to produce the better part of 4,000,000 rounds a month, but this was still less than the requirement, and in any case something like three-quarters of their ammunition was destined for the Western Front.

The artillery problem was further complicated by the fact that shrapnel was inefficient against trenches, only the few rounds that burst immediately above them would shower the heads of the defenders. What was really needed were bigger high explosive shells, with fuzes that burst on or around ground level to blow out sections of trench, causing earthquakes which shattered dug-outs and blast which concussed and tore the defenders like an iron hand. Such shells and such guns needed technologies, materials, and labour forces that most countries were ill equipped to provide. Even in Britain nine out of every ten rounds manufactured were shrapnel shells, and the vast majority of projectiles produced were for light field guns and 4.5in howitzers. Heavy high explosive shells were conspicuous by their absence; for the 9.2in howitzer,

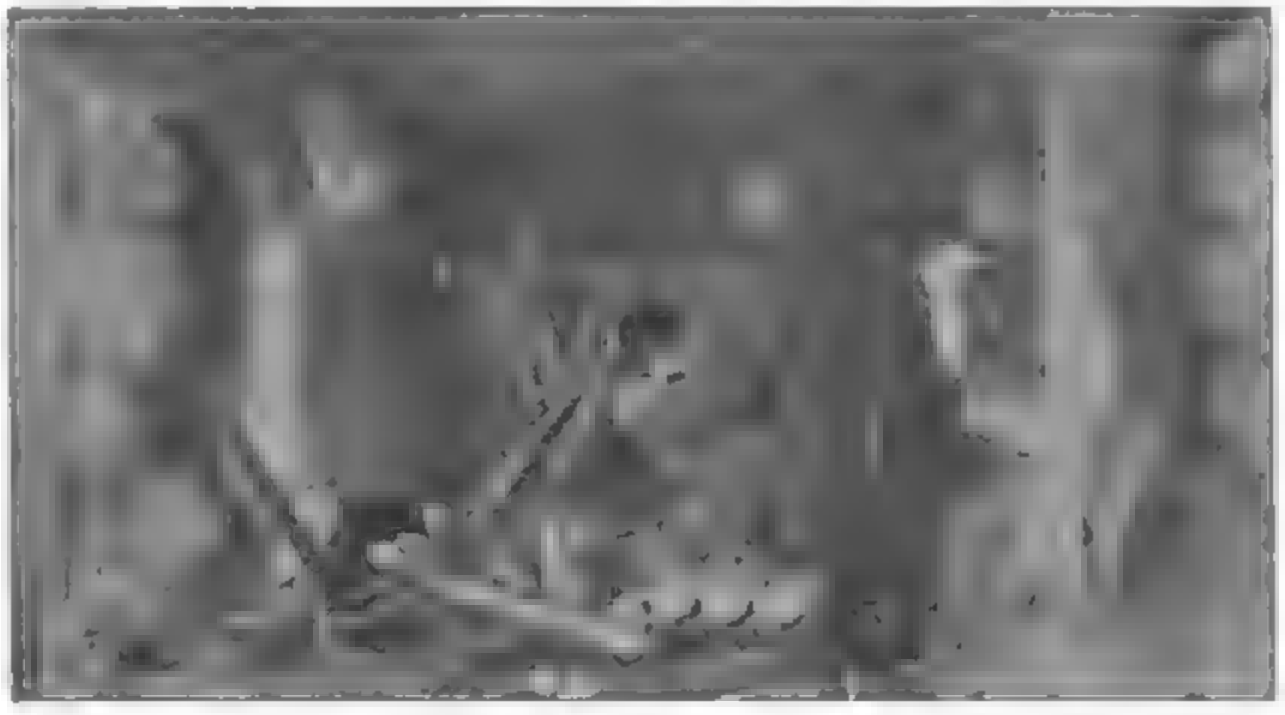
The German 21cm Mörser and its monstrous 120kg (265lb) shells in their wicker containers. Increasing proportions of heavy guns made deeper cover in the trenches ever more attractive.

Trench smashed by shellfire, Argonne front – probably in the French lines. Wicker gabions have been torn up and the sandbagged walls have collapsed.

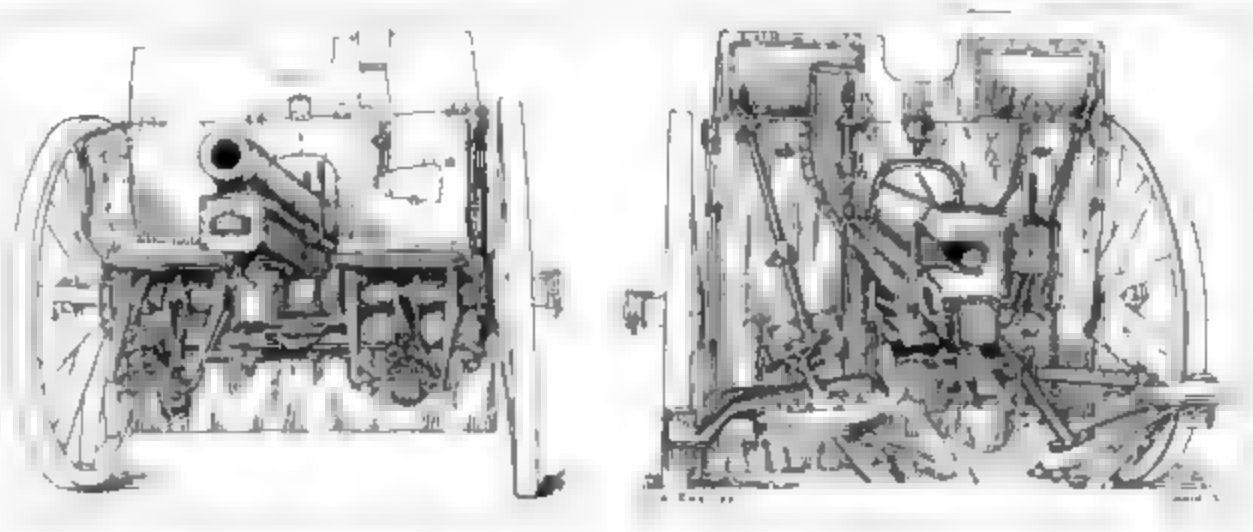
total production for 1914 would be just 200 rounds. Rushed production by an inexperienced industry also led to such dangerous fiascos as the 'fuze, graze, No.100', an impact-detonated shell fuze lacking proper safety devices or any external indication of its arming status, which led to a rash of premature detonations in the gun breech with serious loss of life.

The shell scandal would help bring down the British government and led to the formation in late 1915 of a Ministry of Munitions under David Lloyd George; but there was no instant panacea. The experience of Lt.Col. D.H.Drake-Brockman of the Garhwal Rifles at Aubers Ridge in 1915 was probably typical: 'If one telephoned up to the gunner officer for a little ammunition to be expended on some bomb gun or Minenwerfer that was annoying us, the reply generally received was "Sorry, but I have used my allowance!". This was, at that time, eighteen rounds daily per battery.' It was, as BEF commander Sir John French complained to the Minister of War, Lord Kitchener, so inadequate as to render successful offensive operations 'quite out of the question'.

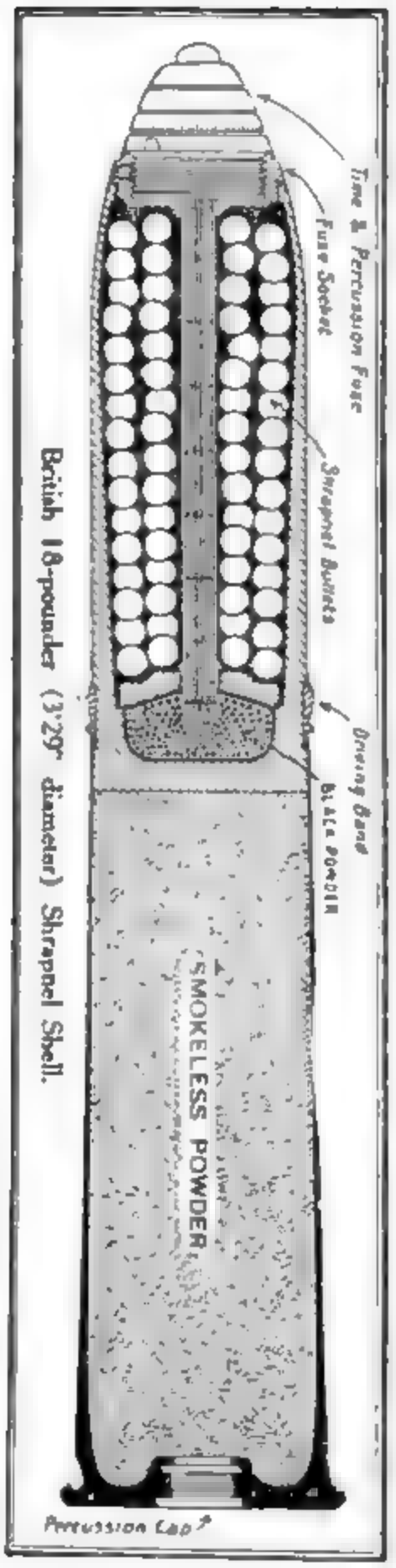
For the Germans, balancing the demands of munitions production with keeping the maximum number of troops in action was partly achieved in September 1914, when Lt.Gen. von Falkenhayn, the Minister of War, also became Chief of the General Staff. Yet the Germans were later frustrated by lack of raw materials, since metals like tungsten, copper, and chromium and materials like cotton and silk had all been mainly imported before the war and were now subject to blockade.



German 7.7cm field gun on the Argonne front, in an emplacement built from fairly massive treetrunks. Note the wicker shell carriers (bottom right); and the gun number '2' – German field batteries originally comprised six pieces, later four.



Line drawings of the German 7.7cm Feldkanone C96 'new model'. Firing a 6.8kg (15lb) *Einheits* or 'universal' shell, or a 1914 model HE shell, this standard German field gun was arguably superior to the older French 75mm.



Cutaway diagram of the British 18pdr shrapnel shell. Once fired from its brass propellant case the shell was intended to burst in the air, showering 364 lead shrapnel balls over the enemy – highly effective against large targets in the open, but only marginally useful against field works. Wartime production of this munition alone exceeded 72 million rounds.

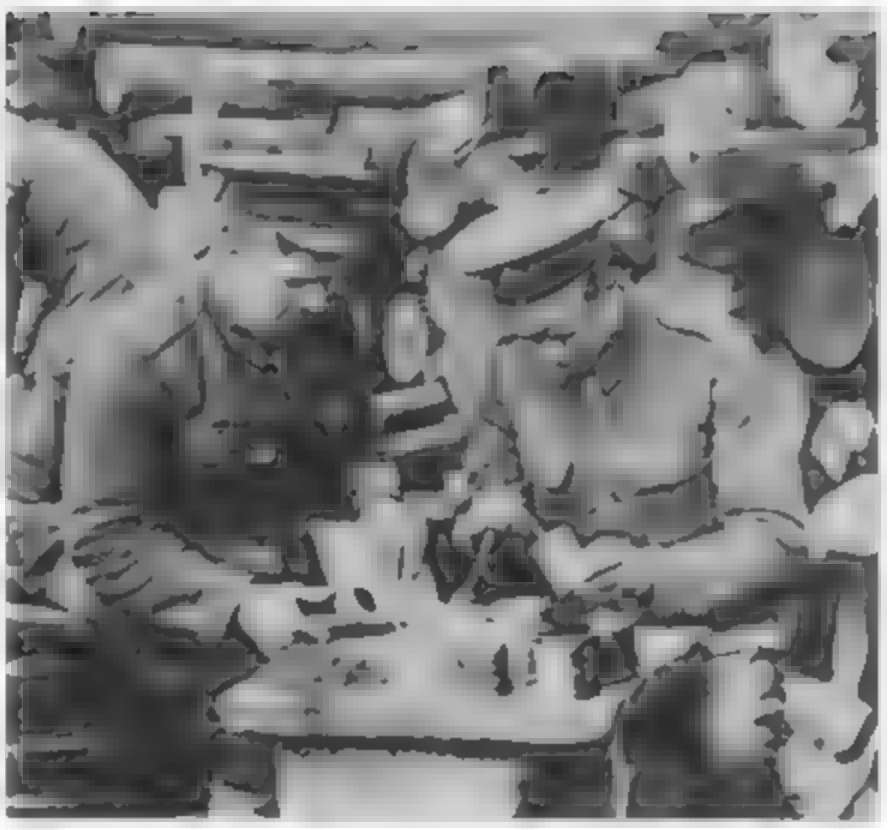
Hand grenades

The situation regarding grenades was just as bad. Before the war grenades had almost universally been seen as a 'siege' weapon, unlikely to be of much use in a war of rapid manoeuvre. At the outbreak of war Britain had only one type of hand grenade, available in very limited numbers and used only by the Royal Engineers. This was the expensive, long handled, impact-detonating 'Grenade, Hand, Mark I' which had been introduced in 1908. Expansion of supply to meet demand would be a Herculean task, first faced by Col. Sir Louis Jackson as part of 'Fortification and Works', later as part of 'Engineer Munitions Branch', and finally as Trench Warfare department of the new Ministry of Munitions. At the outset the French were little better off, with their antiquated ball grenades; and even the Germans, who had given more thought to the matter, had only a few hundred thousand grenades. These were mainly the impact-detonated 'discus' bomb, and the M1913 black powder ball or Kügel grenade with a friction-ignited time fuze.

The gross inadequacy of grenade provision was all too apparent. In late 1914 Sir John French estimated demand for hand grenades at 1,000 per week; deliveries ran at a ludicrous 70 per week in November, rising to a slightly more respectable 2,500 by the second week in December. Meanwhile demand was spiralling out of control, with 10,000 bombs a week demanded in the first week of 1915. Within six months estimated demand would be 2,000 bombs a day, with a projected requirement of anything up to 50,000 per day when Britain's 'New Armies' took the offensive in the field. Under such conditions, and with a lead time of months required to design decent bombs for mass production and establish proper factories, improvisation was the keynote. 'Emergency' supplies of bombs were therefore rapidly obtained from two major sources: conversion of existing home factory production lines of other goods to produce very simple types of temporarily expedient bombs, and the ingenuity of the troops themselves. Other nations came to much the same conclusions.

So it was that in and behind the front line trenches the troops took to producing 'jam tin' and 'racket' bombs. The 'jam tin', a particular favourite with the British, consisted of a tin filled with dynamite or gun cotton packed round with scrap metal or stones. From the top of the tin projected a length of Bickfords fuze connecting to the detonator. As the official publication *Notes from the Front* explained, it was crucial that 'very careful' experiments be conducted to establish the correct length of fuze. It was generally calculated that each inch of fuze would give a second and a quarter delay. The grenadier lit the fuze manually and hurled the bomb, hoping that the time fuze had been correctly cut to explode neither so quickly that it blew him up, nor so slowly that the enemy had time to pick it up and throw it back. The fuze could be lit with matches, but the uncertainty of ignition and difficulty of manipulating matches and bomb meant that men tended either to work in pairs, or to keep a glowing pipe or cigarette in their mouths.

Naturally enough, the exact design of the 'jam tin' varied with the materials available. Fighting at Gallipoli, Lt.Col. M E Hancock of the Northamptonshire Regt favoured a fairly heavy bomb made by the Royal

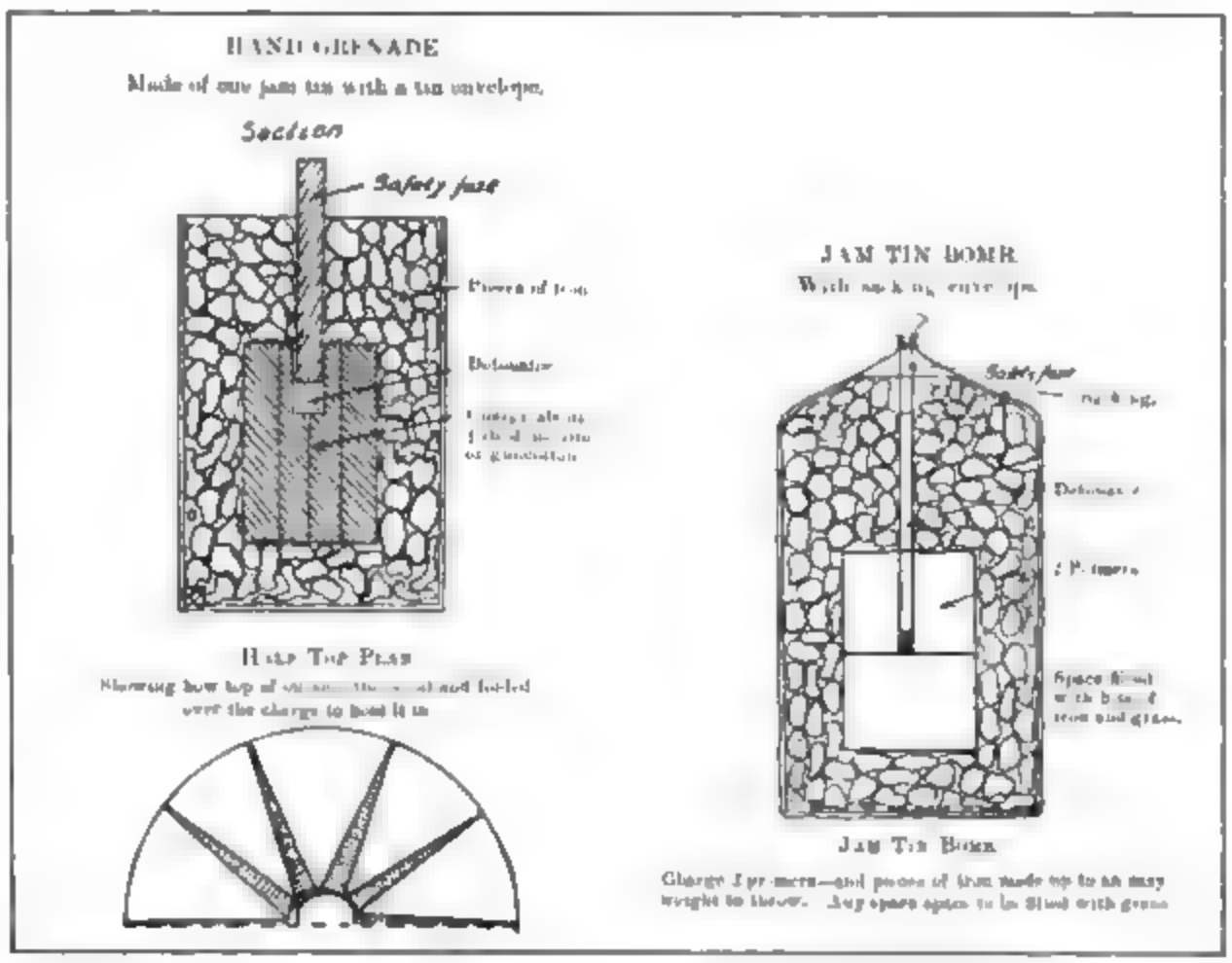


The manufacture of 'jam tin' bombs as depicted in *Illustrated War News*, April 1915.

Engineers, with an eight to ten second fuze lit by cigarette, which was 'bowled' out of the trench to a distance of about 30 yards. The Turks replied with similar but lighter devices with thinner cases. Some of these failed to explode, so Hancock and his men gathered them up at night to throw back later. Major G.E.Horridge of the Lancashire Fusiliers was provided with 'jam tins' with wooden lids and 'friction igniters', which in theory were set alight by rubbing against a rough surface. At Le Pantin in the winter of 1914 men of 2nd Bn. The Black Watch made bombs under the instruction of an artillery officer which consisted of gun cotton packed in tobacco tins. The Australians sometimes used a slightly more sophisticated factory-made variation with a percussion-ignited time fuze, which they dubbed the 'Welsh Berry'. Just how petrifying a duel with such bombs could be is underlined by the account of Lt. P.Neame of the Royal Engineers, who was called upon to stem an enemy bombing attack near Neuve-Chapelle:

'I ran forward and asked what was going on. The first answer was from the Germans, for a black object the size of a cricket ball came sailing through the air, landed in the trench behind us and burst with a terrific bang and the whine of whirling bits of metal. The sergeant told me that he was the bombing sergeant of the West Yorks and that the two men with him were all that was left of his bombing squad, the rest having been killed or wounded. He said that the German bombs out-ranged our own, that our bombs were 'duds' and he could not get them lighted.

Diagram from a British manual showing the construction of improvised 'jam tin' bombs. Such was the shortage of grenades in 1914–15 that most nations employed both factory-made 'emergency' types and improvised bombs such as the 'jam tin', which were fabricated by the troops themselves.



'We were interrupted by a fusilade of bombs this time coming from two directions, some of which landed in the trench and some on the parapet; one of the men with us was wounded... I realised then what it meant to be caught like a rat in a trap... I stood up on the fire step... and threw my first bomb. It hit the parapet near where I could see the Germans and exploded with a roar. Our bombs, though heavy to throw were very violent and destructive... As I stepped down a rifle bullet cracked past close to my head and a fraction of a second later there was a stutter of a

machine gun... While I crouched a German bomb came over, fell right in the crowded trench just behind me and burst with a frightful crash, killing and wounding many of our men... A bomb inflicts terrible wounds. I never saw anything worse in the succeeding years of war.'

A rather more elegant emergency bomb was brought into use by Maj. Basil Condon Battye of 21st Field Coy RE, who had small cast iron cylinders manufactured at Bethune. Like the soldier-made 'jam tins' these 'Battye' or 'Bethune' grenades were fitted with safety fuze and a detonator, but usually ignited by a Nobel fuze lighter, which the soldier could initiate by banging down a cap. Safety was slightly improved by separating bombs and detonators in transit.

At its most basic the 'racket' bomb consisted of explosive attached to a wooden handle shaped roughly like a hairbrush, again lit by means of a length of fuze. In the version recommended to British troops in *Notes From the Front* a slab of gun cotton was wrapped in a sticking covering which also contained metal fragments, and the whole was wired to a wooden handle about 50cm (19ins) long. Though most nationalities used racket bombs they were most popular with the French, who referred to them as *petards raquette*. They produced a number of types, from simple sticks of dynamite wired to wooden paddles, to examples in which the explosive was contained in a metal pipe or provided with a separate method of ignition. The final French version made use of factory-produced components and a percussion lighting device, and was known as the F2, M1915. The Australians also made use of the racket bomb, though they tended to refer to it as either a 'cricket bat' or 'brush back' bomb. An 'emergency' pattern racket bomb was also made in Britain; this No.12 grenade featured a percussion ignition system and an iron fragmentation plate.

Men of the Liverpool Scottish (10th Bn, King's Liverpool Regt), in Q3 trench at St Eloi, 1915. The men wear Glengarry caps, Forbes tartan kilts with khaki drill covers, and the 'Jacket Highland Pattern' or 'Scottish Regiments' with cutaway rounded skirt fronts. Between the two soldiers can be seen a neat wooden rack containing long-handled impact-detonated No.2 'Mexican' hand grenades; disposable bandoliers hang at the left. (Liverpool Scottish)

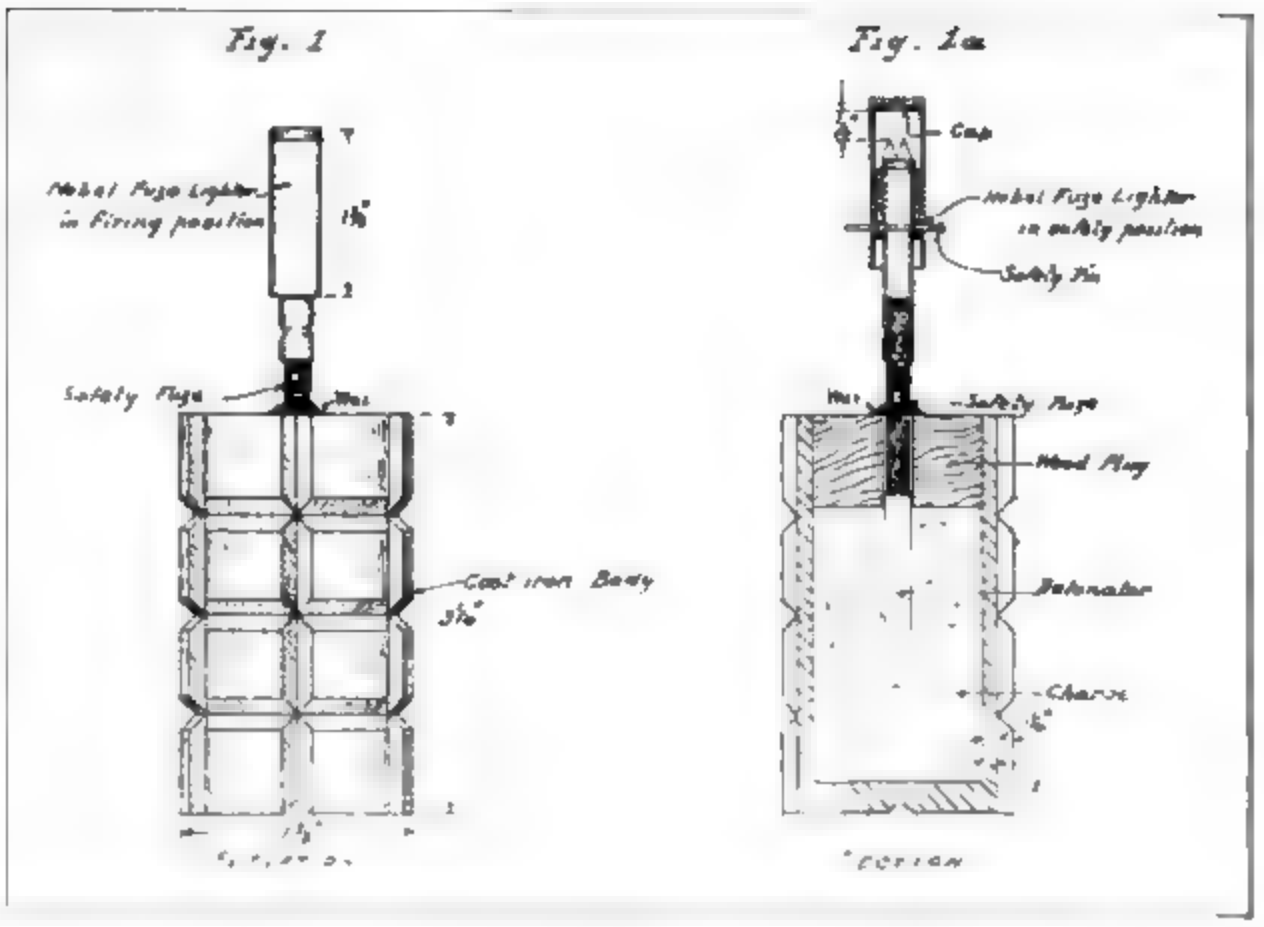
Rifle grenades

Though rifle-projected grenades had been invented by Englishman Frederick Marten Hale before the war, he had been unable to arouse much interest at the War Office. Indeed, only the Germans had shown very much enthusiasm, with the result that the Allies were on the receiving end of their 1913 and 1914 model rodded rifle bombs. Britain was therefore forced to start almost from scratch, at first ordering small supplies of the 'J' or 'Commercial Pattern' rifle bomb which Hale's Cotton Powder

German grenades, c1915. Between two early-model stick grenades are two emergency type tin cylinder bombs, an M1913 impact-detonated 'discus', and an M1913 black powder ball grenade. The early *Stielhandgranate* is identified by the rounded end to the handle; the pull wire for the friction igniter was simply doubled back up the handle and taped in place with a paper band. Unsurprisingly, this dangerous arrangement was replaced in 1916 with a screw-off metal cap which covered the igniter system until needed.

Company were making for export to Brazil. Later, and not entirely successfully, they attempted to place contracts elsewhere.

The basic method of use was similar for all rodded rifle bombs. The rod was slipped into the muzzle of the rifle, and a special blank cartridge was loaded into the chamber. Any safety pin was removed from the bomb, and the trigger squeezed. The pressure created by the explosion of the cartridge hurled the bomb into the air, hopefully to explode on impact in the enemy lines.



The 'Battye' hand grenade, invented by the eccentric Maj. Basil Condon Battye, RE, and manufactured by the Army at Bethune.

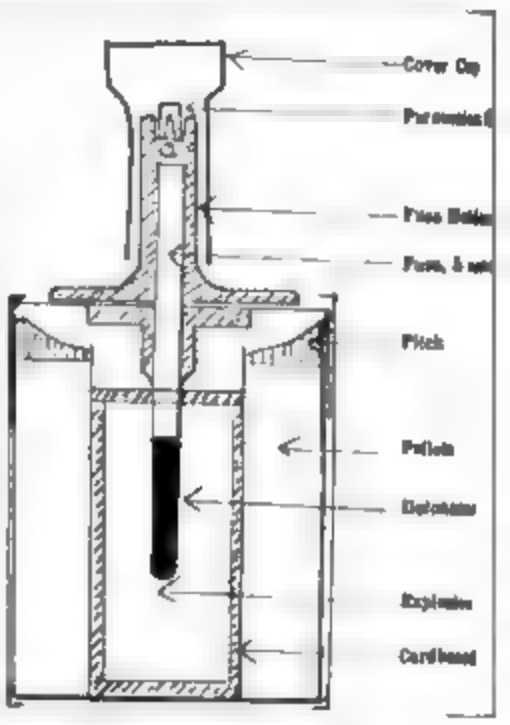
Lack of accuracy and heavy recoil were significant problems. The Germans soon introduced properly made steel launching stands with shock absorbing springs, which could be adjusted for range, the British used wooden stands, made either by Royal Engineers workshops or locally by the troops. In either case the mobility of the rifle grenadier was sacrificed. When used without a stand it was recommended that the rifle be held with the trigger guard upward and the toe of the butt resting on the ground, so as to minimise the damage to both soldier and weapon.

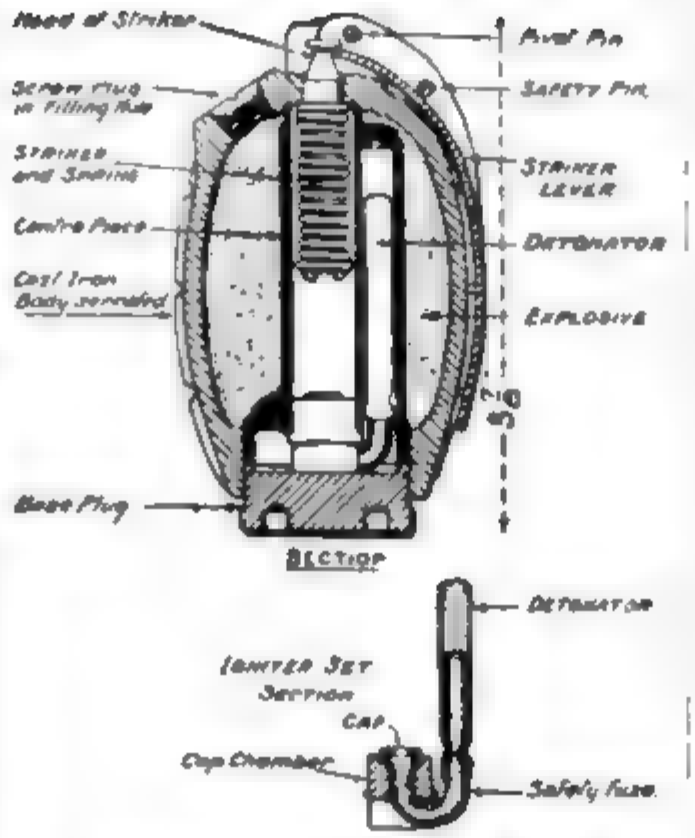
Trench mortars and bomb throwers

These weapons and devices threw bigger missiles and helped to bridge the ranges not covered by hand-thrown bombs or artillery proper. Again the Germans had taken the initiative, and study of the sieges of the Russo-Japanese War had influenced them to design and introduce two types of trench mortar. The heavy 25cm (9.8in) smooth-bore Ehrhardt model *Minenwerfer* had equipped pioneer siege trains from 1911, and at the outbreak of war they had about 190 available. Yet despite this early lead production of German trench mortars was never sufficient to keep pace with demand, so obsolete and stop-gap models were commonly to be seen. A frequently encountered type of the early years was the Lanz, a small, crude 91mm smooth-bore capable of throwing a 4kg (8.8lb) bomb about 300 metres. In the medieval-looking Albrecht mortar a wooden tube was wound with wire for short range, low velocity projection. Locally improvised 'earth mortars' fired 24kg (52.9lb) projectiles relatively short distances from tubes sunk into the ground. There was even a spring-powered *Wurfmaschine* for mechanically propelling hand grenades, which could throw the discus bomb about 200 metres.

The Allied response was even more patchy: not until October 1914 did Sir John French ask for the supply of 'some special form of artillery' capable of dealing with trenches at close range, with the result that no 'official' trench mortar was delivered from Britain until December 1914, and even then the model supplied was declared unsuitable. So it was that

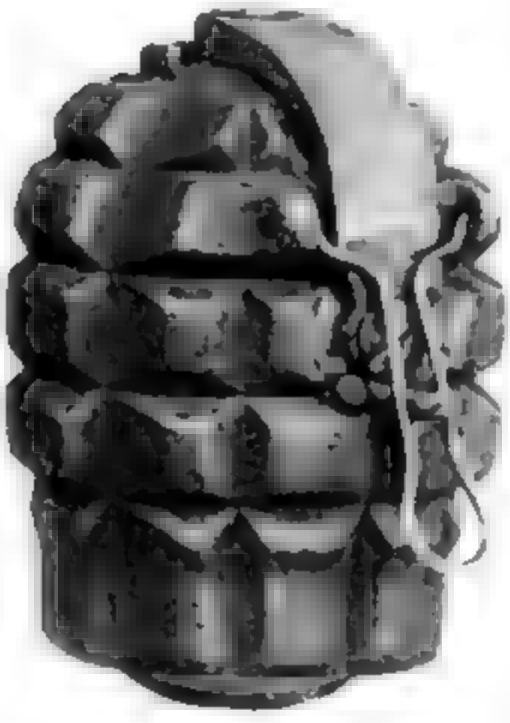
The Australian 'Welsh Berry' bomb.





Bomb, Hand, No. 5, Mark I (Mills Pattern).
Scale ½.
PLATE I.

Sectional diagram of No.5 Mills grenade, first ordered in April/May 1915. This classic segmented cast-iron fragmentation grenade, which soldiered on with few changes for half a century, weighed just under 1.5lb (0.7kg). It was filled with high explosives produced under various commercial names – a painted green band indicated Amatol, a pink band Ammonal or Bellite, etc. The base plug was unscrewed and the igniter set inserted only when the bomb reached the troops. The spring-loaded striker was retained by an external lever and safety pin. When the pin was removed the lever could be held down in the closed hand; released when the grenade was thrown, it allowed the striker to ignite a time fuze set for various delays between four and seven seconds.



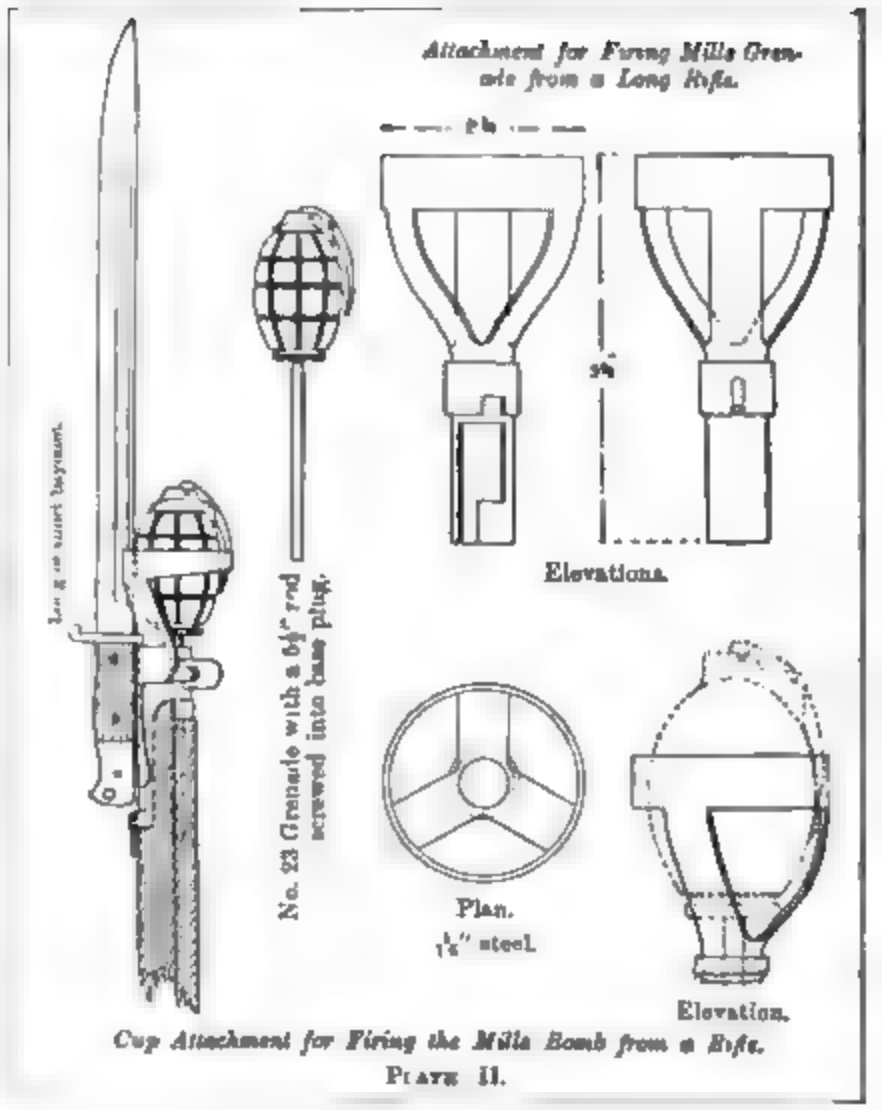
The grenade designed by the Belgian Capt. Leon Roland, which inspired the British Mills bomb. Only a court case would sort out the issues of ownership of the ideas involved. (Musée Royal de l'Armée, Brussels)

until at least the summer of 1915 the British were dependent on a motley selection of experimental and improvised weapons. These included a few shells bored out to form crude bomb projectors; alarming weapons locally fabricated from iron water pipes; and 'pipe guns' which were dug into the ground to throw 4lb tin pots.

Another, and ultimately rather less successful line of development was the 'bomb engine'. On the face of it such weapons had the advantages that they were quiet and required less complex technology, but they were limited by their size, range, and the weight of their missiles. Some were simply catapults improvised by the troops themselves, some, like Dawson's 'Spring Arm Projector' and Pellet's 'Propellor' bomb thrower, were granted patents. Only two such devices were accorded official issue status and manufactured in large numbers. The first of these was the Y-shaped overgrown schoolboy's catapult designed by C.P.Leach and supplied by Gamages, the London department store. Capable of flinging a 2lb projectile 200 yards, each Leach catapult cost £6 17s 6d. First orders were placed in March 1915, and by that October 3,152 had been delivered, the official scale of issue being 20 per division (see Plate F1). Thereafter it was intended to replace the Leach with a French-designed *Sautenelle* projector.

The other British catapult to see widespread use was Capt. West's 'Spring Gun', a heavy metal contraption with a bank of 21 springs, a throwing arm and a cocking lever (see Plate F2). This could be carried around like a stretcher by two or four men. A test conducted by the author, with the kind co-operation of the Imperial War Museum at Duxford, Cambridgeshire, showed that even 70 years later, and set at three-quarters of its full power, the West was capable of throwing a Mills bomb 150 yards; during this test the bomb remained in the air for 5.2 seconds. Guy Chapman, who actually used the West in 1915, was less impressed, observing that anyone unlucky enough to stand in front of its 'whirling arm' was likely to be decapitated. Production of the West and other British catapults was officially halted in the spring of 1916.

Arguably the first really successful British trench mortar, combining power and range with adequate production and supply, was the '2in Trench Howitzer', popularly known as the 'toffee apple' or 'plum pudding' bomb thrower due to its spherical, rodded 50lb (22.6kg) projectile. The weapon itself comprised a relatively small elevating barrel on a heavy wooden bed, fired using a converted rifle mechanism and a lanyard. Capable of a range of about 500 yards, the 'toffee apple' made a


Attachment for Firing Mills Grenade from a Long Rifle.
Elevations.
Plan.
Elevation.
No. 23 Grenade with a 6½" rod screwed into base plug.

Cup Attachment for Firing the Mills Bomb from a Rifle.
PLATE II.

Bombers of 1st Bn, Scots Guards in 'Big Willie' trench at Loos, October 1915. The open box of a dozen No.5 Mills bombs (right) shows how they are packed, with a red-painted tin of igniter sets in the middle and a base plug 'key' provided on the inside of the lid. The man at second left with the strange duckbill-like protuberance is wearing his PH 'tube' gas helmet rolled up; the man to the right of him has the helmet slung in its stowage bag. Note the stiffened SD caps still worn by these Guardsmen. (IWM Q17390)

ABOVE RIGHT **The cup or ring attachment for firing the No.23 rodded Mills bomb from a rifle was introduced in 1916.**

considerable impact, blowing revetments high into the air, collapsing dug-outs, and hurling steel splinters as far back as the British lines. Ernst Junger, of Fusilier-Regiment Nr.73 Prinz Albrecht von Preussen, described them as treacherous and 'personally malignant'. By the time of the Somme offensive in 1916 about 800 had been manufactured.

The French experience offered many parallels. Short of mortars in 1914, they had quickly resorted to 19th century museum pieces and a device known as the *Taupin*. This consisted of a modified shell casing mounted on a wooden block, throwing relatively small bombs a short distance; alarmingly, it was often ignited using a glowing cigarette. They also employed a variety of mechanical bomb throwers, which used both sprung arms and catapult-style slings for their motive power. One example illustrated in the *Times History of the War* was very similar to the Leach; another used parts of a bicycle to cock the mechanism.

Later the French approach became more professional and a number of more conventional designs were produced on a much larger scale. These included a Dumézil model with a 58mm barrel, over which was fitted the tail of a much larger finned 'aerial torpedo' (see Plate J), and a super-heavy 240mm weapon designed by the Société de Construction de Batignolles, and capable of hurling a 100kg (220lb) bomb about 1,100 metres. Due to its weight the mortar could be dismounted into three pieces and trundled about the battlefield in two wheeled, steel-framed hand barrows. The French heavy mortar received a British patent in July 1915, and in 1916 was adopted by the British and Empire armies as the 9.45in (the 'flying pig').

Another French innovation was the Brandt-designed *'pneumatique'* mortar, in which the propellant was compressed gas from a cylinder.

(continued on page 43)

FRENCH BOMBERS, 1914–15

1: Soldat, 8eme RI, 'bracelet bomb'

2: Caporal, 8eme RI, 'racket bomb'

3: Adjudant-chef, Aasen grenade

BRITISH BOMBERS, 1914–15

1. Sapper, Field Company RE, No.1 Mk I grenade
2. Corporal, 1st Bn Cameronians, No.8 grenade
3. Bombing officer, 2nd Bn Leinster Regt, No.15 grenade

2

3

BRITISH SNIPERS, 1915–16

1: 2nd Lt., 2nd Bn DLI, sporting rifle; 1915

2: Irish Guards, SMLE with Lattey optical sights; 1915

3: Camouflage robe & SMLE with off-set telescopic sight; 1916

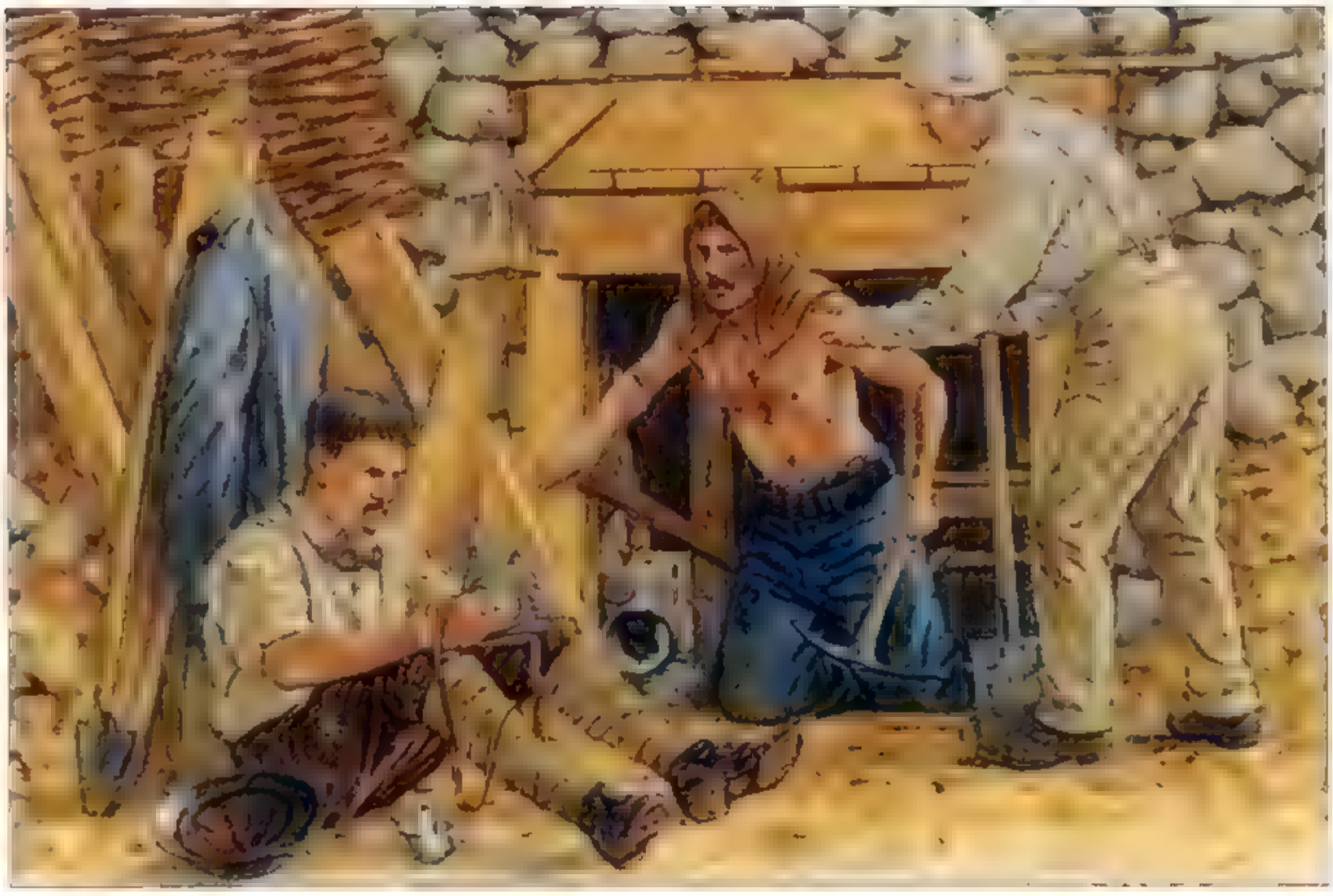
C

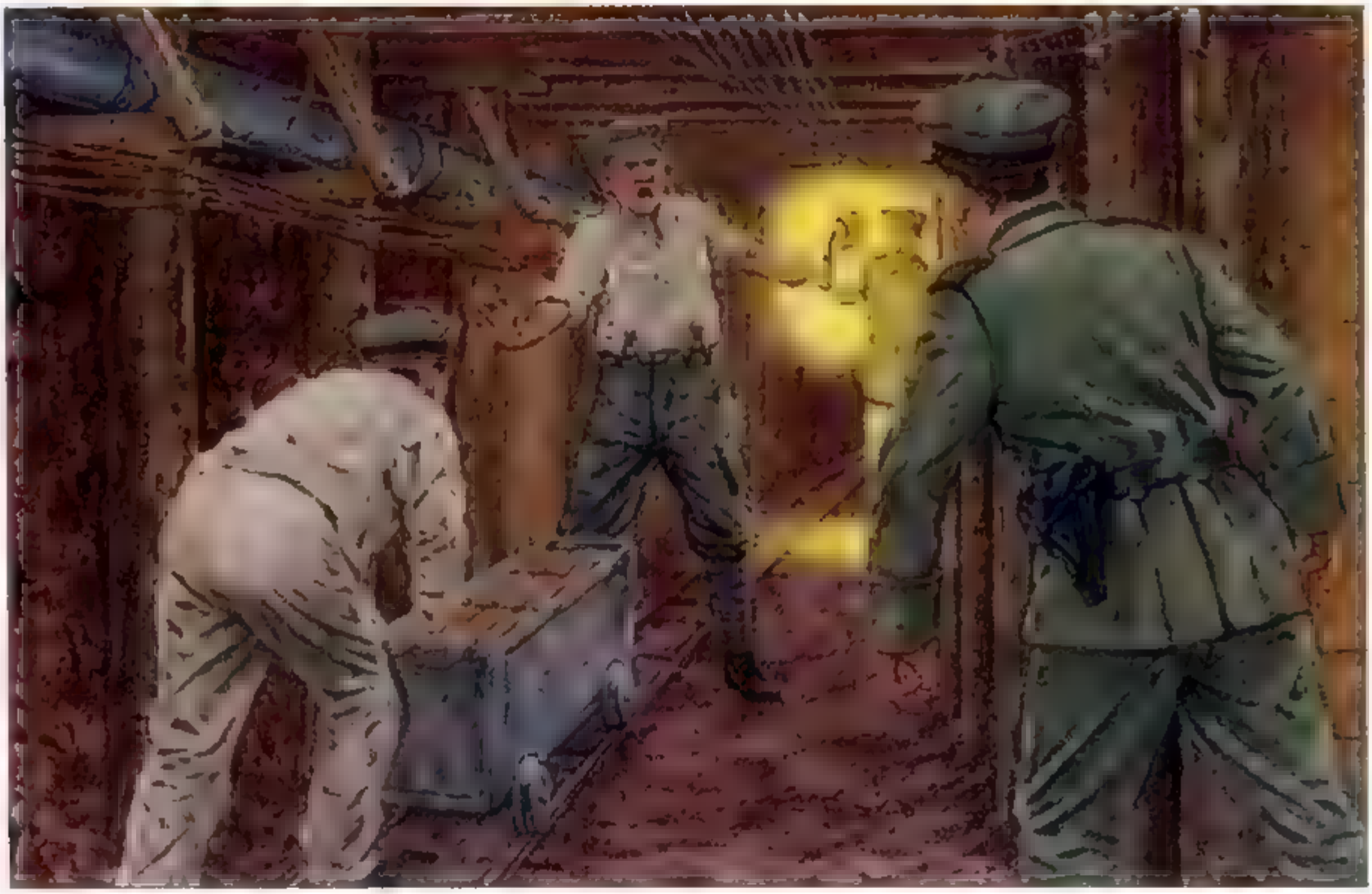
GERMAN MG08 MACHINE GUN TEAM, **Infanterie-Regiment Nr.85, spring 1915**

BRITISH 'BOMB CATAPULTS', 1915

1: Leach catapult; 7th Bn, Royal Sussex Regt

2: West spring gun, Coldstream Guards





MINE WARFARE, VAUQUOIS SECTOR, MAY 1916

1 (top): French *camouflet*, 10eme Division 2 (above). German *Angreifer*, 30.Pionier-Bataillon

ALLIED GASMASKS, 1915–16

1: British Barley mask, May 1915
2: British Hypo helmet, summer 1915
3: British Large Box Respirator, June 1916

4: French P2 mask, October 1915
5: French M2 mask, summer 1916
6: Russian Koumant-Zelinski respirator, 1916

RUSSIAN TRENCH GARRISON, WINTER 1914–15 (left to right)
1: Maxim M1910 gunner, infantry MG section 2: Rifleman, 1st Siberian Rifles Regt 3: Telephonist NCO, Signals Co, 7th Engineer Bn

GERMAN TRENCH RAIDERS.
Reserve-Infanterie-Regiment Nr.110,
La Boiselle, Somme front, April 1916
1: Leutnant group leader
2: Grenadier
3: Unteroffizier, support group
2
3

FRENCH INFANTRY WITH 58mm TRENCH MORTAR, VERDUN, 1916 **1: Soldat de 1ere classe, marching order 2: Mortar man, 66eme RI 3: Gas sentry, 25eme RI**

German officer with G98 rifle mounted on a metal grenade launching stand, complete with shock absorbing spring and elevating arc. The rodded grenade in his hand is the M1914, here with the detonator removed.

The barrel was mounted on a small metal tripod; the M1915 barrel weighed about 22kg (48.5lbs) and the tripod a further 16kg (35lbs) without the cylinder, and was capable of lobbing a 950g (2lb) shell out to about 400 metres. For short periods the Brandt could produce impressive showers of shells, at a rate of anything up to 18 rounds a minute. It also had the advantage of being relatively quiet. The German compressed gas 105mm and 150mm mortars fabricated by Ehrhardt & Schmer at Saarbrücken, which were used on a limited scale, are widely believed to have been copies of the French device.

NEW COMBAT TACTICS

Finding new systems of combat and tactics would prove even more difficult than the provision of new war materials. It was made less than an exact science both by the fact that the enemy was also developing new methods, and by the realisation that new weapons required new patterns of human organisation. Yet almost as soon as weapons became available, tactics were evolved for their use.

In the face of horrendous casualties the German infantry, already under instruction to advance only in more open formations less vulnerable to artillery, were soon experimenting with other methods to reduce losses. One of the first was to launch attacks at dusk, or under cover of mist. Another involved using the metal shields from machine guns as improvised cover. This was less than a total success since the metal plates were heavy to carry, slowed the advance, and protected the soldier from only one direction.

In December 1914 the Garde Schützen were experimenting with assaults by companies rather than battalions, which attempted to break into the enemy line at selected points under cover of darkness and then move down the trenches from either end. At about the same time British troops were reporting particularly galling engagements in which the enemy were pushing forward just a few machine guns and snipers to enfilading positions, and attempting to clear trenches by weight of fire, without launching a conventional attack. Sometimes they would open rapid fire, forcing the defenders down below their parapets, and then advance. By January 1915 the Germans were using grenade throwers drawn from pioneer battalions to front attacks against enemy trench lines. A month later a German assault party made an attack advancing along disused communication trenches without 'going over the top' at all.

One promising line of German enquiry was the attachment of field guns to attacking infantry to deal with machine guns and strongpoints, but the ordinary 7.7cm was found too heavy to manhandle over rough terrain. The firm of Krupp therefore designed a new 3.7cm *Sturmkanone* for the purpose. In March 1915 the high command ordered the formation of a *Sturmabteilung* or 'assault detachment' for testing the new guns with assault pioneers. Their proposed tactics included an advance by the pioneers following a conventional

The No.3 or 'J Pattern' Hale rifle grenade being fired from an SMLE rifle in a wooden launching stand; range was up to 150 metres. The No.3 burst well but had over-complex safety mechanisms.

bombardment, the manhandling forward of the Sturmkannone, and then a full-scale attack by both pioneers and infantry under cover of fire from the light guns. The results were mixed, but did show, even at this early stage, a commitment to experiment on the part of the German leadership.

British theory was not far behind. Before 1914 was out the first little volume of *Notes From the Front* compiled by the General Staff was warning about the avoidance of close formations when artillery and machine guns threatened. Enemy machine guns were admitted to be 'the very devil and magnificently handled', though German rifle fire was not thought equal to the British. Infantry acknowledged that its dispositions were likely to be dictated by exposure to enemy artillery; and a remarkably percipient note by one general officer suggested to his colleagues that 'an advance should not be made on rigid lines, but with clouds of skirmishers – 5 or 6 yards apart – thrown forward according to the ground and available cover'.

A few months later the second part of *Notes From the Front* was telling British infantry that 'small columns in what are known as "artillery formations" should never be adhered to when there is a possibility of their coming under close or medium range fire of infantry or machine guns. Troops have suffered severely from insufficient extension, and the adoption of rigid lines, and also from pushing forward in close formations without taking the proper military precautions. Loose elastic formations adapted to the ground with 8 or 10 paces interval are the least vulnerable.'

Notes on Attack and Defence, published in early 1915, recommended both that attacking parties should always be equipped with bombs, and that an organised plan should be prepared 'for keeping the occupants of captured trenches supplied with these missiles'. By May 1915 General Headquarters had published a composition for a 'Trench Storming Party' which was to consist of 14 or more men led by an NCO. The personnel were to have four distinct functions, respectively: grenadiers; grenade carriers; 'bayonet men' to cover the party and winkle out the opposition, and 'sandbag men' who followed up, blocking side entrances and forming a final barricade at the furthest point of the advance into the enemy trench system.

By the latter part of 1915 it was accepted that new weaponry had fundamentally changed the method of combat. As the British *Training and Employment of Grenadiers* put it that October: 'The nature of operations in the present campaign has developed the employment of rifle and hand grenades to such an extent that the grenade has become one of the principal weapons of trench warfare'. Accordingly it was recommended that not only should every infantryman receive grenade training, but that every platoon should include an NCO and eight men selected from the 'very best, bravest and steadiest' to act as a ready pool of grenadiers, who could act with the platoon or separately.

At roughly the same time the Germans were thinking in terms of the use of the *Handgranatentrupp*, a six- to eight-strong party of grenadiers. In the attack these would lead the way down the trench, bombing and advancing by bounds, rushing each traverse, until they achieved their objectives. In defence the party would either drive the enemy out immediately, or form 'blocks' in the trench. The lead grenadiers would carry no rifles, but pistols, trench knives and bombs. The squad leader would be similarly armed, or if carrying a rifle would advance immediately behind the two lead men ready to fire over them. Strongpoints required that a couple of members of the team take up positions firing on the loopholes of the objective, whilst the remainder worked around it, prior to rushing the enemy with bombs.

Representative engagement: 2nd Bn, Lancashire Fusiliers, 7–9 July 1915

A good example of how things could work out in practice is provided by the defence of captured enemy trenches south of Pilkem by 2nd Bn, Lancashire Fusiliers from 7 to 9 July 1915. The sector had been taken by the Rifle Brigade and Somersets, and now the narrow trenches were 'reorganised to a certain extent' with some parapets reversed, and fresh sandbags thrown up, though they were much battered and many of the dug-outs 'smashed in'.

'The night of 6–7th was fairly quiet, with the exception of enemy bombing parties coming down the three saps. These were kept back by our bombers, who, throughout the time we spent in these extremely unhealthy trenches, acted with the greatest gallantry and devotion to duty. At 11.30am on the 8th the enemy commenced shelling very heavily with 5.9 inch. At about 12 noon a shell landed on the Headquarters dug-out on the canal bank, wounding Colonel Griffin, Captain Spooner, Lieutenant Appleby and Lieutenant Charleston (the machine gun officer), who died a day or two later. A Royal Field Artillery observation officer, who had arrived only a few moments before, was also wounded by the same shell. A box of hand grenades was set on fire at the same time, and Captain Spooner, although wounded... threw them into the canal, thereby averting a very much worse disaster.

'This heavy shelling continued until 3pm, practically every dug-out in the trenches and on the canal bank having been blown in before this hour. At 3pm, immediately preceding their infantry attack, the enemy developed an intense shrapnel bombardment of our lines – a perfect tornado of light shrapnel and "Whistling Willies" mainly aimed at the supports and reserve, and lasting about 20 minutes... Our artillery had an exceedingly good observation post, and kept opening fire and driving back attacks, which our infantry were unable to see from their trenches. All attacks were beaten back. On one occasion the enemy rushed a sap by the hedge, but a party was promptly sent up from "C" Company, and the trench was regained. It was, however, untenable, as our own artillery were firing into it...

'Their attack having failed, the enemy recommenced shelling with 5.9 inch, and continued without intermission during the night and during the whole of the 8th except when they launched infantry attacks... During these bombardments many were killed, wounded and buried, and the trenches in many places blown absolutely flat. Machine

guns were turned onto the gaps which became almost impossible... Lieutenant G.C.Martin, in command of No.14 Platoon, "D" Company, against whose portion of the line the infantry attacks had been principally directed, dug himself in about ten yards in front of his trenches, which had practically all been blown in, thus avoiding to a certain extent the effects of the heavy shelling, the shells going over the new trenches and bursting in the trench previously occupied.

'One of the main features of the action was the bombing. From the beginning to the end it was one continuous bomb fight down one sap, and there was also more intermittent fighting down the other two saps. At the end of this sap there was no protection, as it was too exposed... In the centre of the sap a barricade was constructed of sand bags built up across the trench. The enemy was on one side of this and our men on the other... The Germans were 10 to 15 yards off the barricade. The casualties in this sap were mainly from sniping.'

During a period of little more than 48 hours of defensive action 2nd Lancashire Fusiliers threw 8,000 grenades, and lost 93 men killed or died of wounds, 13 men missing, and 274 wounded. During their ten-week tour of duty casualties amounted to 50 officers and 2,300 rank and file, or more than double the initial strength of the battalion.

1915: AN OVERVIEW

Despite rapid advances in weaponry and small unit tactics no offensive on the Western Front was rewarded with anything but the most trivial of gains throughout 1915. The French winter attacks in Artois were dogged by bad weather and lack of artillery, and beat fruitlessly against Vimy Ridge. The Champagne offensive which continued until 17 March resulted in massive French casualties in exchange for a few insignificant villages. In the Vosges the Chasseurs Alpins duelled with German Jägers for the tactically useful height of the Hartmannsweilerkopf, which they eventually secured, but without any breakthrough. This was all rationalised as a 'nibbling' strategy; but to the enemy at least it seemed likely that France would eventually be defeated by such victories.

British efforts were no more successful. Sir John French's resources were as yet comparatively modest, and in view of the 'Easterners' commitment of what new British forces were available to Gallipoli, Mesopotamia, Egypt and elsewhere, his attacks were hardly likely to be conclusive. Neuve Chapelle in March 1915 demonstrated that good preparation and a short bombardment could get troops into the enemy trenches; but it was not clear how they were to get beyond them without either a way to get artillery swiftly across the battlefield, or communications which could deliver information which was not already long out of date.

Renewed Allied offensives during May at Vimy, Festubert, and Aubers Ridge, and in June at St Mihiel, could claim no more than the most localised impact. In the autumn a more co-ordinated effort, with the French again attacking on the Champagne and the British at Loos, generated more casualties, and acrimony, which would lead to the replacement of Sir John French with FM Sir Douglas Haig in December. Whilst the year was essentially a catalogue of failure it

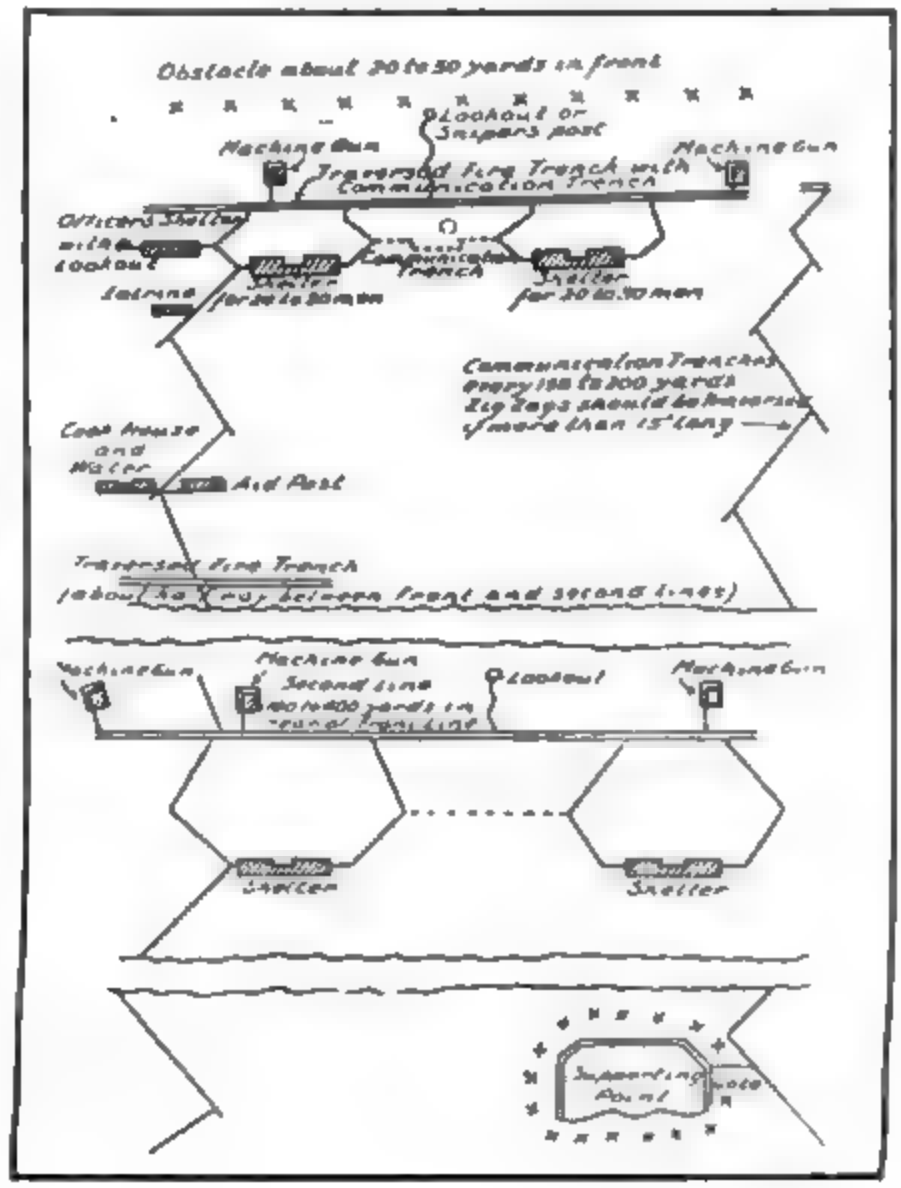
should not be assumed that all attacks were the same, still less that no one was giving consideration to new ways to break the deadlock.

In this context the document which has undoubtedly attracted most attention is Capt. André Laffargue's influential *Attack in The Present Phase of War*, based on his experiences at Neuville St Vaast in May 1915. This suggested that infantry should attack in waves supported by their own light machine guns and mobile artillery, overwhelming or by-passing the enemy. Most critically, he argued that defences in depth could not be 'nibbled' away, since an enemy would take advantage of the time to reinforce, or dig more lines. Bitter though it might be, trench systems had to be 'swallowed in a single gulp'.

Versions of Laffargue's appreciation were later circulated not only by the French, but the British, Americans, and even the Germans. Yet Laffargue's critique was only one of many, and certainly not the first. As early as April 1915 the Germans had prepared a detailed memorandum which analysed the latest French attacking methods. Amongst other things it criticised the French for reliance on artillery, failure to use counter-battery fire, and the narrowness of the frontages assaulted. It offered the advice that the attacking companies should be in from four to six lines, that assault troops should go lightly equipped using grenades, and that reserves should be 'brought up as far forward as possible', having infantry gun teams with them. Delay was to be avoided at all costs, otherwise 'we shall find ourselves in a cul-de-sac in far more unfavourable circumstances than we started'.

Both this paper and others, which detailed the latest thinking on defensive positions, were captured by the British and widely circulated. It was very clear that both sides learned from each other, often within a few weeks of an event. Furthermore the beginnings of 'big pushes', hurricane bombardments, infiltration, and mixed combat groups were apparent even by mid-1915. The problems would be integrating these disparate ideas, training and equipping the troops, and using them for a worthwhile strategic result.

The ideal trench plan, from the British Army's *Notes From the Front (III)* of 1916. There are two main trench lines between 100 and 400 yards apart, and both lines are provided with machine gun posts and shelters. Latrines, cookhouse, and aid post are positioned on the communication trench joining the lines.



New weapons:
Poison gas

Though there had already been small experiments in the use of gas, the first major discharge was made from the cylinders of Pionier-Regiment Nr.35 near Ypres on the morning of 22 April 1915. Entirely unprepared, the French Colonial troops in the path of the cloud of choking yellowish-green chlorine broke and fled 'like a flock of sheep'. Serious inhalations of chlorine had hideous effects, destroying the alveoli of the lungs, and drowning men in the liquid that their own damaged bodies created. Only the ability of the Canadians to create a new front behind the existing line prevented a disaster.

The Germans' use of this new weapon seems to have been regarded as an atrocity – 'frightfulness',

in the usage of the day – by even tough-minded front line eyewitnesses. CSM E.A.Shephard of the 1st Dorsets, whose battalion suffered badly at Hill 60 on 1 May, linked the gas attacks in his diary with the loss of women and children aboard the torpedoed *Lusitania*, and wrote that 'the Dorset Regiment's motto now is, "No Prisoners"' – but he also urged immediate British retaliation in kind.

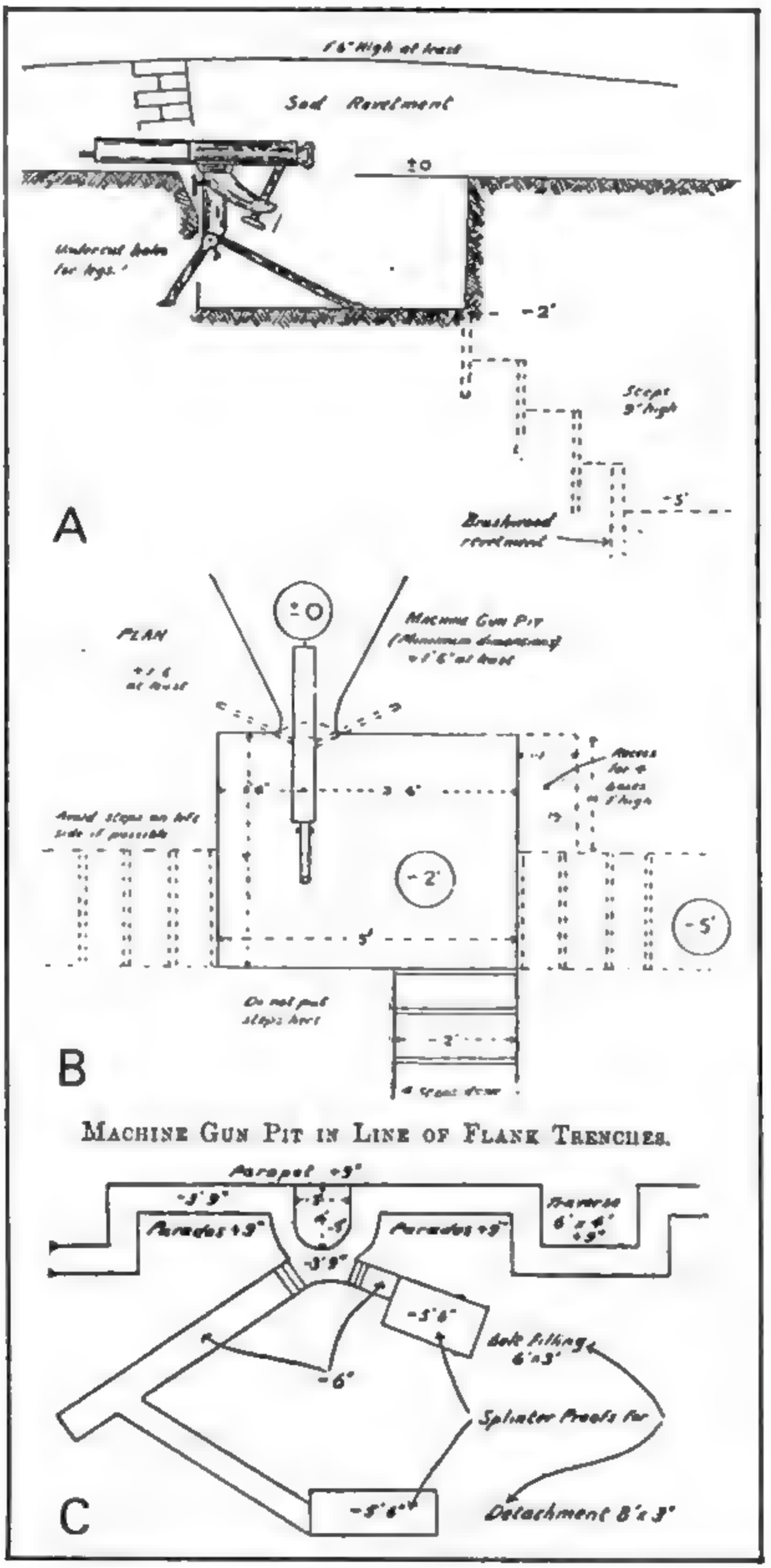
Over the next few weeks, while German gas attacks continued, the Allies struggled to find effective counter-measures, beginning with handkerchiefs soaked in water or urine, and 30,000 cotton wool pads made up as a result of a *Daily Mail* appeal. Yet gas was no wonder weapon: it was dependent on the right weather, which was a gentle breeze blowing towards the enemy; upon the ability to get cylinders into the front line, and to protect one's own men from its effects. Moreover, as the war progressed it was proved to be surprisingly non-lethal: while more than a third of men hit by shell splinters and bullets were killed, fewer than one in 20 of gas casualties died. Indeed, official figures showed that though the British Army suffered nearly 13,000 gas casualties in 1915, there were only 307 fatalities. During 1916 just 1,123 were killed by gas out of a total of well over 100,000 fatalities to all causes; moreover, though there were those who were permanently disabled, 93 per cent of all gas casualties returned to duty, most of them within a few weeks.

Like so many other facets of trench warfare, the use of poison gas would become a technological, tactical, and industrial struggle in which both sides strove month by month to stay one step ahead of the enemy. The race was both offensive and defensive. Within a month the British had begun to produce their own chlorine; within two months they had decided on the formation of 'Special Companies' of Royal Engineers for the release of gas, and were conducting experiments at Runcorn, Cheshire. In the summer both sides were working on new gases, with the French producing phosgene on a small scale in Calais by August 1915, though the Germans were first to use it that winter. Phosgene proved more powerful than chlorine, and was relatively difficult to detect.

In the meantime British and German scientists were experimenting with artillery shells which could deliver gas. Though both shells and cylinders would ultimately be widely used, in the short term the theorists came to opposite conclusions as to their respective merits: the British believed that shells were inefficient in delivering the necessary concentrations; the Germans, that shells were more useful than cylinders, both for their surprise value and their ability to hit specified targets.

There was also marked divergence on the defensive side (see Plate G). By 8 May 1915 the British were graduating from impregnated pads to flannel 'helmets' which were pulled right over the head, and tucked under the uniform collar to close the open end of the hood. The first of these was the 'Hypo' helmet developed by Capt. Cluny Macpherson, a medical officer to the Newfoundland Regiment. The modified Phenate-Hexamine model, with two eye pieces rather than a single window, improved chemical impregnation, and an exhalation valve for the mouth, was known as the 'PH' or 'tube' helmet. Captain Hitchcock of the Lemsters received his in July 1915, though a great improvement over gauze and pads, it was sticky and messy due to the impregnating solution. A few months later Capt. J.C.Dunn described how the 2nd Bn, Royal Welsh Fusiliers went into action at Loos wearing their 'awful' gas helmets rolled up on the head, pulling

OPPOSITE **British MG post, from *Notes From the Front*, 1915, shown in section (A) and plan (B). The pit is a shallow excavation cut into the forward wall of the trench for the tripod legs, and a recess in the right side wall for ammunition boxes. An embrasure allowing an arc of fire is cut into the parapet, providing at least 16ins of side cover above ground level; the '+' and '–' figures refer to above and below ground level. Steps lead down to the trench floor from the right rear of the gun. (C) shows the general arrangement of an MG position in plan; ideally, two splinterproof dug-outs were provided, one for ammunition storage and belt-filling and one for shelter from bombardment.**



MACHINE GUN PIT IN LINE OF FLANK TRENCHES.

them down only at the last moment, mainly to protect themselves against British gas which was blowing back in their faces.

French gas masks showed similar stages of development. Impregnated pads secured around the head with cloth loops, which had been in use from soon after the first use of gas, were followed by experiments with a hood design. By August 1915 the French Army was using an impregnated fabric design which covered the face, but not the top of the head, and was fitted by means of metal strips and tapes. Though this was improved to produce the 'M2' mask in April 1916, French troops were still poorly protected.

Following the variously impregnated pads, which were of only limited use, the Germans came to a more complex solution. This was a rubberised fabric mask with eye pieces, and a separate cylindrical screw-fit filter which could be changed once its filling had become ineffective. The mask came in three sizes and was carried in a grey cloth bag. Yet even as the new German mask entered full scale production in September 1915, the firm of Boots of Nottingham was co-operating with the British Ministry of Munitions in the development of a new generation of 'box' respirators. In these the masks were attached by pipes to separate and still more effective filters.

Flame throwers

The use of flame as a weapon of war had a history which dated back to ancient times, but the problem of the early 20th century was to harness it in a practical form and develop suitable tactics for the battlefield. As early as 1910 German inventor Richard Fiedler had patented a double cylinder back pack device with a flexible hose for delivering squirts of flame under the power of compressed gas. A form of this was adopted by the War Ministry as the *Kleif* (short for *Klein* – 'small' – *Flammenwerfer*) in 1912. In January 1915 a flame thrower detachment for active service was formed under the leadership of Reserve Hauptmann Reddemann, a Leipzig fire officer in civilian life who had collaborated with Fiedler's experiments before the war.

The Flammenwerfer detachment first saw action against the French at Malancourt in February 1915, when pioneers with light flame throwers advanced across a particularly narrow stretch of No Man's Land which had already been scorched by fixed *Gross* – 'large' – flame throwers. As a result of this successful experiment the detachment was enlarged to a full battalion, designated the 3rd Guard Pioneers. However, the Allies were now alerted to the problem, and actually managed to capture at least one equipment by March 1915. Later *Flammenwerfertruppen* were attached to the *Sturmbataillone* (assault battalions).

Flame thrower attacks were terrifying both to receive and deliver, as the 2nd Leinsters discovered when subjected to 'liquid fire' at Hooge on 31 July 1915. As Capt. F.C.Hitchcock recorded: 'The defenders of this sector had lost few men from actual burns, but the demoralising element was very great. We were instructed to aim at those who carried the flame spraying device, who made a good target. It was reported that a Hun who had his cargo of frightfulness hit by a bullet blew up with a colossal burst'. Counter-measures against an attack were with rapid fire and machine gun fire. As the flames shot forward they created a smoke screen, so we realised we would have to fire "into the brown".'

As a response to the German Flammenwerfer the British and French rapidly commenced programmes of their own. Devices were quickly put forward to the military by the American inventor Joseph Menchen and the French Hersent company. A practical-looking 'portable flame projector' was patented in London by W.A.Hall. In December 1915 British Capts.Vincent and Hay actually produced a 'knapsack' flame thrower capable of about 35 yards range, which was demonstrated experimentally at Wembley. Yet the Allied powers were slow to be convinced of the practicality of man pack models, and concentrated instead on larger installations and light mortars for projecting canisters of flaming fuel.

By the end of 1915 the German General Staff had issued detailed instructions for tactics to be used with flame projectors. Essentially flame weapons were seen as offensive, although the small models could be used against counter-attacks. The six-company 3rd Guard Pioneer Bn now had 20 or more large flame throwers, and 18 man pack weapons per company. Prior to attacks the large projectors were to be built into positions where the

Starting in October 1915, Vickers machine guns were withdrawn from British infantry battalions, who now relied on the new Lewis light machine guns for mobile firepower. The Vickers guns were now grouped into companies of the Machine Gun Corps, which specialised in concentrated fire missions – both defensive, and offensive when they employed 'machine gun barrages' against distant targets. This MGC Vickers team in early 1916 use the Mark IVB tripod mount, but a small 'emergency' mount is also stowed folded under the barrel jacket. Both men have Phenate-Hexamine ('tube') gas helmets tucked down inside their collars, with two eyepieces and a rubber exhalation valve for the mouth. The firer wears a padded waistcoat with rope 'straps' at the shoulders, to help bear the weight of the gun or tripod in transit.

A Territorial of the South Lancashire Regt using a periscope rifle near Bois Quarante, 1915. (Queen's Lancashire Regiment Collection)

German front came within about 30 yards of the enemy line, with each projector covering a front of about 55 yards. A flame company was thus capable of mounting an attack over a frontage of 1,100 to 1,640 yards.

The assault party, which was to include both pioneers and infantry, was ideally to be rested prior to the attack. It consisted of the assault party proper with bombers, engineers for the demolition of obstacles, and small flame throwers; a consolidating party; a group for the construction of new communication trenches to the captured zone; and a carrying party to take forward barbed wire, grenades, sandbags and ammunition. Special stores like short ladders, loophole plates, concentrated charges, and signal pistol ammunition were similarly to be stockpiled in advance. Assault troops were to wear 'assault order', without packs but including greatcoat, shelter quarter, water bottle, four days' rations, rifle and bayonet with at least 200 rounds, and two hand grenades. 'Consolidating' men were similarly equipped but carried their rifles slung without bayonet, and carried a loophole plate, 50 sandbags, and a heavy entrenching tool.

The flame attack was prefaced by the explosion of charges to create gaps in the obstacle zone, and wire-cutting. Following a signal the large projectors were then ignited, spraying the enemy line for no more than a minute before the troops attacked boldly. As the General Staff document put it:

'The assaulting troops must be instructed that they have nothing to fear from the flames and smoke, nor need they fear that they may themselves be caught by the fire jet, as this is cut off simply by turning a tap prior to their advance. They must understand that they can advance immediately after the cessation of the spray without danger, as small bursts of flame on the ground... will burn out at once, and a little fire on the ground is at once extinguished when trodden upon. It is most important to impress upon the troops that the assault is much facilitated by the use of the flame projector, as after a flame attack the enemy fires very little or not at all...

'The assault is made immediately after the flame attack. The assaulting party charges, followed closely by the consolidating party. The small flame projectors allotted to the assaulting party attack any machine guns that are still in action, blockhouses that are still being defended, etc., with short spurts of fire... It is of the highest importance to drive out the enemy simultaneously to a considerable distance on either flank by means of bombing and flame projector detachments, and to construct sandbag barricades at these points.'

VERDUN

The end of 1915 marked a nadir in Allied fortunes. The Russians had been pushed back across their western province of Poland, and Franco-British efforts on the Western Front had been thwarted. The Gallipoli

adventure had proved to be just another bloody blind ally; and unrestricted submarine warfare now appeared to offer Germany an escape from blockade and encirclement. While the Allies planned great efforts for 1916, involving both Britain and Italy on an increasing scale, the initiative lay with Germany. The German high command faced serious strategic choices, however.

An indefinite defensive posture was at best unproductive, and one in which the 'balance of numbers' might still lead to slow strangulation. Attack on the Eastern Front appeared pointless, since Russia's offensive power was now blunted and internal strife seemed likely to keep her weak, whilst 'advancing on Moscow takes us nowhere'. Yet, as Gen Erich von Falkenhayn, Chief of the General Staff, observed, 'Within our reach behind the French sector of the Western Front there are objectives for the retention of which the French General Staff would be compelled to throw in every man they have. If they do so the forces of France will bleed to death... .' Thus was born the plan, codename *Gericht*, for attack at Verdun: a salient strongpoint in the front surrounded by forts, symbolic of French national pride and resistance. Secrecy was paramount, and every precaution was taken to distract attention from the vital *Schwerpunkt*. Diversionary actions were begun at wide intervals elsewhere along the front – at Masons de Champagne and Neuville in January 1916, at Ste Marie à Py, Tahure, Obersept, Vimy and Souchez in February.

Von Falkenhayn assumed, correctly, that the assault on one of France's most important fortresses would result in retaliation elsewhere, and his initial dispositions included reserves left in other sectors to deal with such responses. He was, however, incorrect in thinking that the Allies would be able to mount major operations immediately – and totally in error if he thought that these events would revive a war of movement, as he is said to have opined to Gen. von Kuhl. He was also unrealistic in his chauvinistic assumption that the French would suffer five casualties for every two German.

Though only nine fresh divisions were allotted to the first onslaught at Verdun, planning was thorough, and it was claimed that important lessons had been learned from Allied failures. Not only was this assault to be a 'big push' in which successive waves would participate over time, but deep bunkers or *Stollen* had been constructed in which infantry could wait until needed. New rail lines were laid for the movement of prodigious quantities of stores. These included several hundred tons of barbed wire, a million sandbags, and 2.5 million shells. The artillery fire plans pitted the heaviest artillery against the French forts, while the 21cm siege guns were to pulverise the front line. 'Boxes' of fire would cordon off sectors from reinforcement, and just before the attack French batteries would be treated to gas shoots. Importantly, it was reckoned that the 1,220 artillery pieces devoted to Verdun would so blast

British design for 'sortie steps' dug into the parapet, allowing troops to go quickly 'over the top'.

FIG. 6.—"SORTIE STEPS" IN FIRE TRENCHES.

Section.

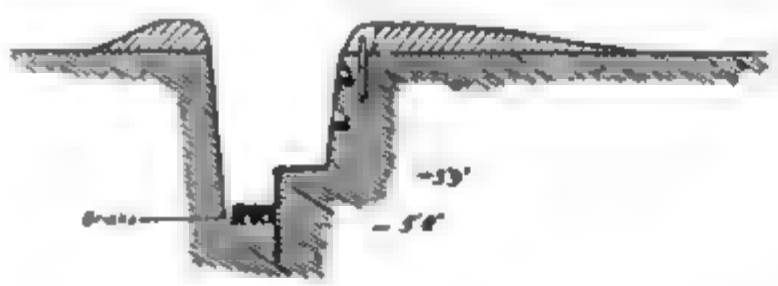
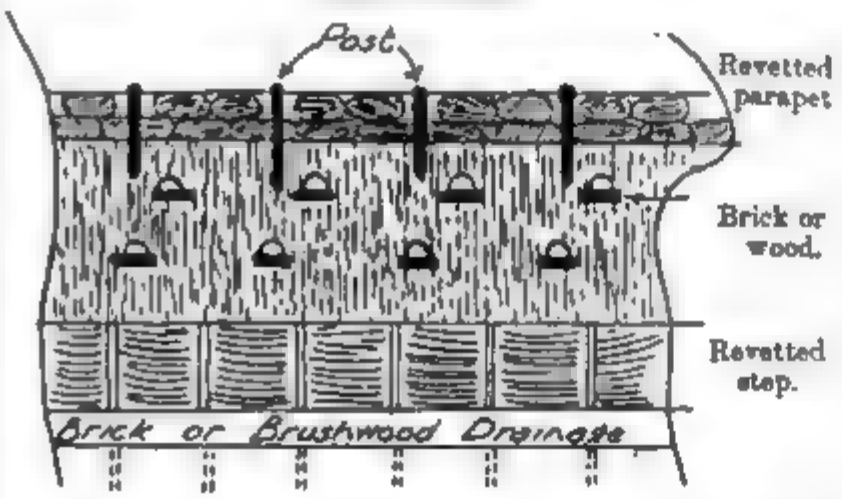


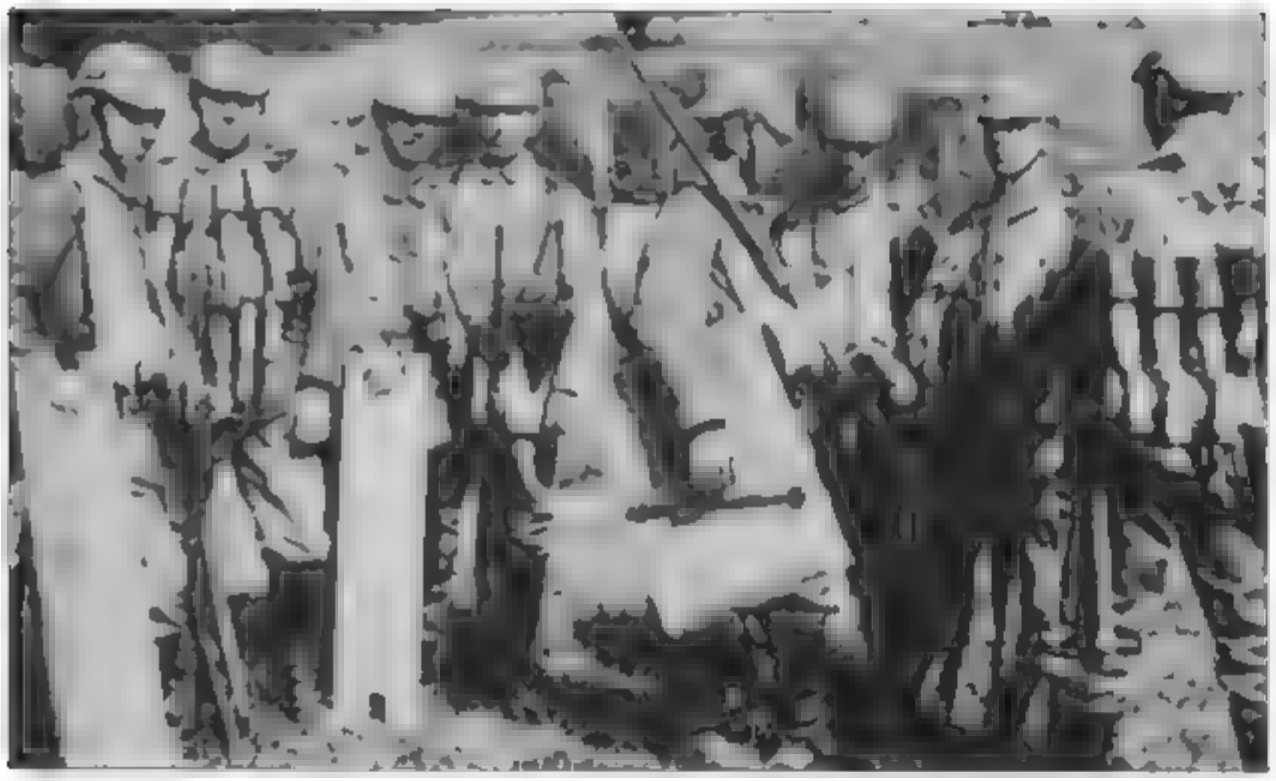
FIG. 7.

Interior elevation.



One stout post to be driven into parapet about 1 foot in front of trench and two steps to be cut in interior slope as shown for each man.

Hold rifle in right hand, place left foot in lower step, pull up with left hand grasping post, place right foot in upper step, then left foot on top of parapet.

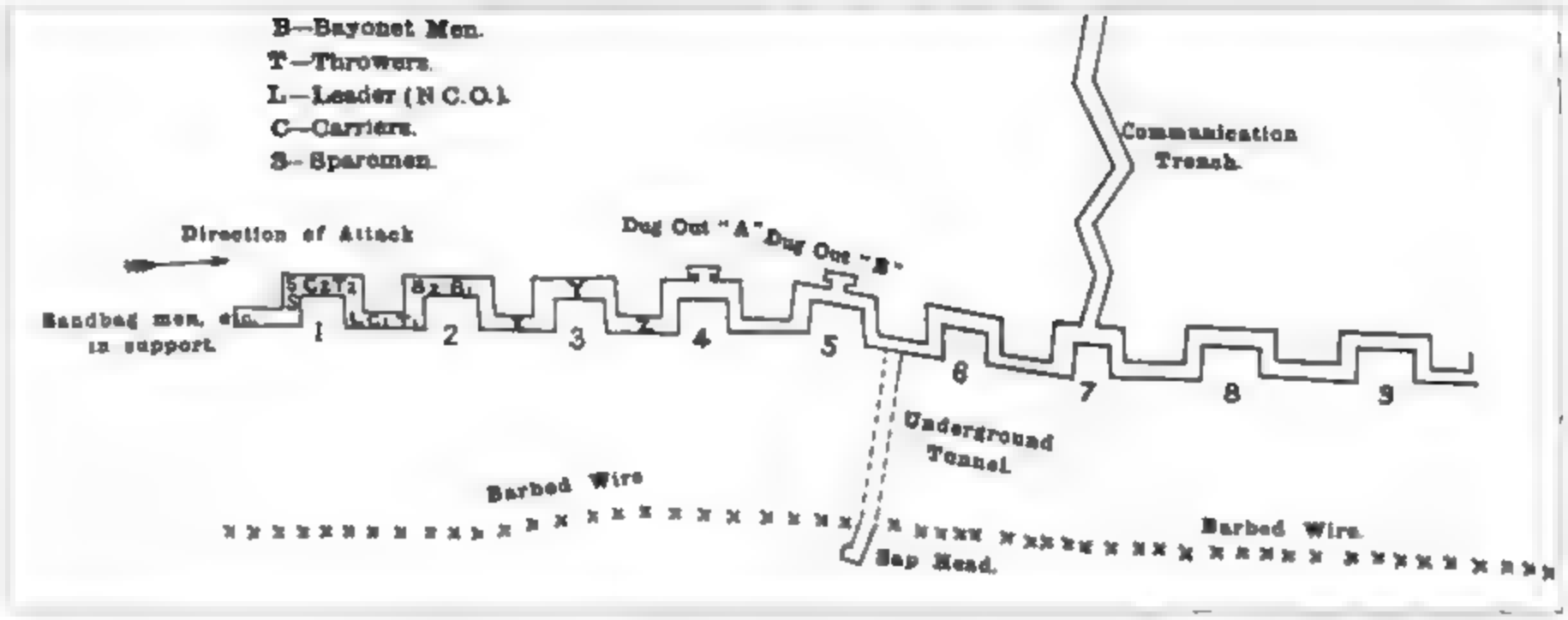


A German assault squad from Fusilier-Regiment Nr.40 Karl Anton von Hohenzollern. They wear *Pickelhaube* helmets without spikes in accordance with regulations of late 1915, and are fully equipped for bombing their way along trenches before setting up a blocking position. Stick grenades, ammunition bandoliers, spades, planks and empty sandbags are carried. The soldier in the centre carries the *Infanterie-Schutzschild*, or 1916 type metal loophole plate.

the enemy lines with 'an unbroken sheet' of shells that the infantry would be able to advance with only minor casualties. It was not the last time that such an assumption would prove fallacious.

Bad weather delayed the attack until it was feared that surprise was lost; but at 6am on 21 February 1916 the Germans unleashed a shattering bombardment which could be heard almost a hundred miles away. That afternoon the first infantry left the German trenches, wearing white brassards as a recognition sign; their mission was to seek out weak points which the main attack would exploit on the morrow. Yet so promising was the advance of these patrols that Gen. von Zwehl's VII Reserve Corps was immediately pitched into the Bois d'Haumont, and fell upon an already decimated enemy. A battle which would last six months and cost a quarter of a million lives had begun. On 22 February, following further bombardment, full scale attacks were led in by pioneers and flame throwers, but again it was Zwehl's corps that garnered the best success, clearing Haumont village. Over the next two days, despite bitter fighting and counter-attacks, the mauled French 72nd and 37th (African) Divisions were expelled from the line, creating a dangerous gap.

On 25 February the Germans achieved probably their greatest coup of the battle, almost by accident. That day Lochow's III Corps was programmed to advance to a point about half a mile short of Fort Douaumont. This was a self-contained moated rampart which, though planned 30 years previously, had been modernised as recently as 1913, and was currently assumed to be beyond the power of the attacking forces. The French high command had decided that locking large garrisons in forts was counter-productive; consequently, Douaumont's garrison had been reduced to about 60 men, just enough to man her main armament. An order sent at the opening of the offensive for men to be poured back into her underground barracks and earth defences remained unfulfilled. So it was that when a section of Brandenburg pioneers fronting Infanterie-Regiment Nr24 Grossherzog Friedrich Franz led the way unbidden down the ditch of the mound they called the 'coffin lid', others followed into what appeared to be simply a handy shelter from bombardment. Nearby French infantry assumed the enemy, now so far forward, to be friendly troops, and held their fire. A rather bemused pioneer sergeant named Kunze was first inside the fort; he captured part of the garrison, then inadvertently let them go; but he was soon joined by two companies of the 24th, and the whole of Douaumont was secured. For this action two officers, Hauptmann Haupt and Oberleutnant von Brandis, were decorated with the Pour le Mérite, Germany's highest decoration.



British bombing tactics, from *The Training and Employment of Grenadiers*, autumn 1915. This shows how a trench might be cleared by a grenadier party, with the enemy being 'rolled up' rather than attacked frontally. The party is led by two 'bayonet men', followed by a 'thrower' and 'carrier', and then by the NCO. A second thrower/carrier team follows him, followed by two 'spare men', and then by a support party with sandbags etc. for building quick barricades across the end of the cleared section of trench.

The collapse of their defences on the right bank of the Meuse during the first few days' fighting now stirred the French to well-nigh superhuman efforts. Von Falkenhayn had been optimistic in expecting that this reverse would break French resolve. The expansion of the British sector in the north had freed up the French Second Army, which was rapidly redeployed to fill the void. Second Army was led by the hitherto obscure 60-year-old Gen. Philippe Pétain, who proved to be the ideal man for the task. Unimpressed by the 'Grandmaison' doctrine of attack at all costs, he was a respecter of firepower who would husband men and material when possible; he would nevertheless defend tenaciously, and would not shrink from huge sacrifices when these were demanded. German attacks had gained five miles in the first few days; from now on they would gain only a few hundred yards of what American Ambulance driver Amos Wilder would call a 'calcinated and inhuman landscape'.

Where initial French stupefaction had helped to keep German casualties to sustainable proportions, repeated blows at the same places met with more stubborn resistance. As one French artilleryman observed from the banks of the Meuse: 'At the top of the ravine, on the edge of the plateau, was a great heap of Germans. They looked like a great swarm of bees crawling over one another; not one was standing. The whole ravine was grey with corpses; one could not see the ground they were so numerous; and the snow was no longer white. We calculated there were fully 10,000 dead at that point alone, and the river ran past dappled with patches and streaks of blood'.

Every push by the Crown Prince's Fifth Army would be met by fresh French battalions struggling along what became known as the 'Sacred Way' into the 'Meuse Mill'. Motor transport was deployed on a greater scale than ever before, with 3,500 lorries endlessly driving back and forth between Bar-le-Duc and Verdun, the much-shelled road being kept open only by the constant toil of Colonial troops posted at short intervals along its length.

By mid-March 1916 the Kaiser was admitting privately that he could see no end to Verdun; Gen. von Gallwitz was heard to quip that the town would finally be reached, at the earliest, in 1920. Yet the battle went on, with bloody attacks up the feature known as the Morte Homme ('Dead Man's Hill'), and the capture of the Bois d'Avocourt on 20 March. The

French responded doggedly to every reverse. On 9 April the Germans launched a general assault on both banks of the Meuse; one unit struggled onto what they assumed to be the top of the Morte Homme only to find that they were on a false crest, short of the true summit; again French counter-attacks swept them down. As Lt. Raymond Jubert described it, the French infantry were assembled as stealthily as possible, and dumped their knapsacks in favour of extra ammunition and a day's rations before advancing under bombardment, and sometimes under machine gun fire capable of hurling men bodily into the air. They found the trench near the summit 'empty – but full of corpses', and regained possession.

The enemy were now reduced to tunnelling, and blasting the hills ceaselessly with artillery. Eyewitnesses noted with macabre fascination how shells buried the dead, then disinterred them, then cut them into ever smaller portions. According to one estimate the German artillery expended anything up to 17 trainloads of shells in a single day.

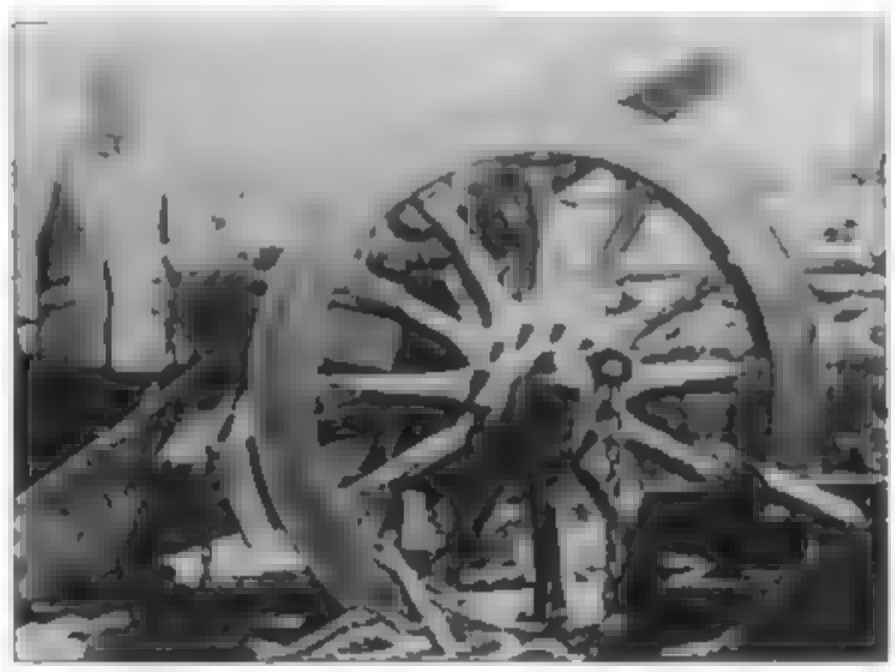
Perhaps strangely, Pétain now faced criticism for a perceived failure to counter-attack strongly enough. He was given a face-saving promotion away from Verdun to the command of Army Group Centre on 1 May, and was replaced by the more aggressive, even profligate Gen. Robert Nivelle. An important French artillery position behind Hill 304 fell soon afterwards, and in the Crown Prince's memorable phrase the Morte Homme now flamed 'like a volcano'. It was finally taken at the end of May. Even so the French continued to fight back, at one point almost regaining control of Douaumont. The moment of real crisis, which had 'threatened the very existence of France', was passing.

At the beginning of June 1916, Operation May Cup carried the Germans inch by inch over Fort Vaux, against a resistance which has gone down in the annals of French military history. The defenders under Maj. Raynal first fought off the enemy flame throwers with bombing attacks, then called down artillery fire on their own position to kill German miners who attempted to tunnel in. Reduced to drinking their own urine, and fainting from explosive fumes and the concussion of shells, the last of the defenders were finally forced to show the white flag on 7 June.

The battle of 'annihilation' – a word said to have passed Von Falkenhayn's lips in a private moment – eventually saw more than 50 German divisions pass through Verdun. An actual majority of the French Army was also rotated through the sector, under the so-called 'Noria' system designed to move battalions out before they became so wasted as to be useless. Yet even this most attritional battle, in what was fast becoming a total war, was not without tactical innovation.

The German experimental *Sturmabteilung*, or 'assault detachment', had been transferred to Fifth Army before the opening of the battle, and had been committed to the initial assaults in small groups wherever resistance was expected to be stiffest. By 1 April the unit had been increased to a battalion under Hauptmann Willy Rohr. In its expanded form the *Sturmbataillon* would field a complete machine gun company, and a battery of

An entrenched German 15cm heavy field howitzer of a Landwehr foot artillery battery, 1915. Though much German artillery was of the latest types, escalating demand would mean the continued use of obsolescent equipments, particularly with the Landwehr and on the Eastern Front.



Hauling a French trench mortar into position using the two-wheeled hand barrow. (Section Photographique de l'Armée Francaise)

mountain howitzers in place of the 3.7cm guns it had previously used. In May 1916 the high command took the important decision that every army would send men to Rohr's battalion for training in the latest assault methods. These men would pass on their skills on returning to their formations, so that new regimental and divisional assault units could be established throughout the German Army.

For the time being, however, there would be fewer opportunities to put these new offensive lessons to the test. As Rupprecht of Bavaria, commander of Sixth Army, put it, Von Falkenhayn seemed to have lost sight of the big picture while mesmerised by his *Ermattungsstrategie* or 'campaign of attrition'. On the other hand, as Winston Churchill noted at the time, the French had suffered more than they should 'by their valiant and obstinate retention of particular positions' which of themselves had no strategic value. While small unit tactics had undoubtedly advanced, co-ordination of the various arms, and strategy, had not kept pace. As Chief of Staff Gen. von Knobelsdorf argued for the resources to finish the job, his leader now held back. The last triumph would be the capture of the ruins of Fleury on 23 June, by the Alpen Korps expertly supported by Rohr's assault battalion, the flame throwers of the 3rd Guard Pioneers, and phosgene gas. Another attack on 11 July was doomed to failure.

Towards the end of 1916 the French would succeed in regaining much of the ground lost around Verdun: but by now the war had entered a new chapter. The long-awaited all-out British offensive in the north had begun. Von Falkenhayn had been sent off to the Eastern Front, and Joffre had been replaced. New players, and new ways of war, would now take centre stage.

French front line trench on the Aisne, July 1916. The parapet is revetted with planks, apparently tied with wire to stakes behind them, and topped off with sandbags – loopholed steel plates were often built into these at intervals. The nearest sentry has a sacking cover on his Adrian helmet to help it blend in with the parapet. The earth firestep is raised at intervals with timbers and sandbags. The overhead cover in the background, of timber, sandbags and earth, is planted with metal piquets and barbed wire to prevent its use as a bridge by attackers.

THE PLATES

A: FRENCH BOMBERS, 1914–15

A1: Soldat, 8eme Régiment d'Infanterie, autumn 1914

This private wears the infantry uniform and field equipment of 1914 with a 'mechanic's blue' cap cover; his regiment is identified by the patch on the stand collar of his M1877 greatcoat of 'blued-iron grey'. His M1888/92 leather belt equipment with Y-shaped shoulder braces incorporates two 40-round and one 30-round cartridge pouches and the frogged bayonet for the 8mm Lebel M1886/93 rifle; he also wears a slung canteen with mug, and a *musette* haversack for rations and small kit. A second haversack holds a number of *Modele 1914* grenades or 'bracelet bombs', essentially unchanged since 1847. As the 81mm spherical bomb left the hand the cord attached to the wrist strap pulled a friction igniter, the M1882 fuze, giving a four-second delay before the black powder charge exploded.

A2: Caporal, 8eme Régiment d'Infanterie, winter 1914–15

Many of the types of improvised *petard raquette* required manual ignition – hence this soldier's smoking of a pipe in action, to provide an instant source of flame less awkward to handle than a box of 'lucifers'. This example of the 'racket' or 'hairbrush' type of grenade has a slotted handle allowing slinging from a cord. This NCO wears the rather motley clothing typical of the first winter of the war. The low visibility uniform of *'bleue horizon'* had already been ordered but was slow to arrive in quantity; this *kepi* of a light blue/grey shade piped dark blue, ordered in September 1914, was one of several headgear in use simultaneously. The *garance* trousers of 1914 were often replaced with brown corduroy during the massive army expansion of this period, and the leather anklets by puttees. Over his greatcoat – note the scarlet double stripe of corporal above both cuffs – he wears an open-sided sheepskin tabard with a caped shoulder effect, held closed by his belt.

A3: Adjudant-chef, French infantry, spring 1915

This warrant officer, after a photograph of several men similarly protected and armed, wears trench armour: an improvised iron body shield in a tent-cloth cover, and the iron *calot* 'skull cap' which was issued from March 1915 for wear under soft headgear before the appearance of the steel helmet. He is armed with the M1892 8mm revolver; and with the unusual Danish-invented Aasen Type C 'parachute grenades', used in very limited quantities by both the French and German armies. This shrapnel grenade was armed by pulling a long cord from the handle as it was thrown; thereafter it detonated on impact, but the wooden buffer on the black-painted head ensured that it did so above ground. As a senior warrant officer – note the 35mm red-on-gold wartime rank stripe above his cuff – he wears a privately purchased officer-style four-pocket tunic and semi-breeches in 'horizon-blue'. Officers were ordered in December 1914 to acquire these for themselves, so many slight differences of colour and detail were seen. The collar patches in yellow with dark blue piping and numbers (gold for this rank) were also ordered worn from December 1914 but were relatively short-lived.

Belgian grenadier, c1915, with long-handled stick grenades suspended from his belt. (Musée Royal de l'Armée, Brussels)

B: BRITISH BOMBERS, 1914–15

B1: Sapper, Field Company Royal Engineers, August 1914

At the outbreak of war it was expected that grenades would be strictly specialist weapons, and they were initially available only to the Royal Engineers. This regular sapper wears the smart regulation service dress with which the BEF went to war: M1905 cap, M1902 uniform and M1908 webbing equipment. He is armed with the expensive Hand Grenade No.1 Mk I (or 'Service Handgrenade, Brass, with Cane Handle and Detonator') introduced in July 1908. The sapper unwound the long single streamer which was supposed to control its flight; twisted the cap to the 'fire' position; pulled out the safety pin; and then threw the grenade, well up to ensure that it landed nose first, detonating on impact. It was not suited to use in confined spaces; and anyway, supplies were quickly exhausted.

B2: Corporal, 1st Bn, The Cameronians (Scottish Rifles), spring 1915

Simpler bombs were produced in greater numbers as the war progressed. This No.8 or 'Double Cylinder Light Pattern' was a slightly improved version of the various 'jam tin bombs' improvised at unit level, and was introduced from May 1915. Weighing about 2lbs (0.9kg) and measuring about 3ins high and across, it had an inner charge of Ammonal surrounded by an outer sleeve holding half-inch steel shrapnel balls packed in resin. Its Nobel time fuze was ignited by pushing down a cardboard tube at top centre.

B3: Bombing officer, 2nd Bn, Prince of Wales's Leinster Regiment, summer 1915

This second lieutenant wears conventional service dress,

field boots, and 'Sam Browne' leather equipment with a 0.455in Smith & Wesson revolver; note this regiment's traditional whistle pocket on the cross brace. The brass bomb badge pinned to his right upper sleeve is unofficial, later a cloth badge of a khaki worsted grenade with white flames was sanctioned to mark this appointment within infantry battalions. Heavy losses would lead to attempts to prevent officers leading 'grenadier parties' in person. He wears an early type six-pocket canvas 'grenade waistcoat', and carries a No.15 or 'ball' fragmentation grenade. This was another emergency measure, introduced early in 1915 and used in quantity, particularly at the battle of Loos. The cast iron body, filled with Ammonal or Blastine, weighed 1lb 6oz, and was fitted with a five-second time fuze for hand use. Its appearance explains why the bombers' early nickname was 'anarchists'

C: BRITISH SNIPERS, 1915–16

C1: 2nd Lieutenant Oliver, 2nd Bn, Durham Light Infantry; Hobb's Farm, Houplines, spring 1915

This officer, taken from a well-known photograph, typifies the early 'freelance' period when British sniping was conducted on an individual basis, largely by officers with pre-war game hunting experience who provided their own weapons. Oliver, armed with a sporting rifle, wears service dress with scarf and rubber boots and, unusually for this date, a field service cap.

C2: Sniper, Irish Guards, summer 1915

The early dominance of No Man's Land by German snipers led to an official programme of sniper training from spring 1916; British First and Second Armies set up scout-sniper schools, and battalion sniper sections were established. The Boy Scouts' fleur-de-lys badge became that of the scout-sniper; this Irish Guardsman wears it in buff worsted beneath a regimental patch with 'I' and 'G' flanking the St Patrick's star badge. Working from within the trench, he has improvised a camouflage hood from a sandbag and local vegetation. His only field equipment would normally be a cloth ammunition bandolier and the bag for his gas helmet. His weapon is a selected example of the standard 0.303in SMLE, fitted with pre-war 2x power Lattey optical sights; these magnifying lenses, clipped to the front and rear sights, had a tiny field of vision and were not as effective as true telescopic sights, but were relatively cheap and available.

C3: Sniper, 1916

Much of the specialist training of British snipers was initially provided by the Lovat Scouts, a unit raised from Highland gamekeepers and deer stalkers. Camouflage suits were widely improvised by snipers for working in No Man's Land, including canvas robes copied from the French. This figure is taken from a surviving example which appears to be an issue item; a long, loose canvas robe of light drab green, splashed with disruptive daubs of black, white and light brown paint. It is worn with a matching hood, which is tucked inside a long wrap-around extension from the right collar; matching gauntlet mittens; and improvised sandbag camouflage leggings over the boots and lower legs. The SMLE rifle is fitted with a Periscopic Prism Company 2x power telescopic sight off-set to the left of the receiver, and is camouflaged with hessian strips. (For further details of this subject see Elite 68, *The Military Sniper Since 1914*.)

D: GERMAN MACHINE GUN TEAM, IR NR.85, SPRING 1915

The Maschinengewehr 08 was a typical and effective water-cooled Maxim design, fed with 7.92mm ammunition from 250-round fabric belts. With a total weight of around 50kg (110lbs), it was generally transported behind the lines in machine gun company carts. In the front lines tactical movement could be achieved either by unclamping the gun from its 'sledge' mount, or by pivoting the latter's legs to allow it to be carried stretcher-fashion, as here. It was often

Men of 2nd Bn, Argyll & Sutherland Highlanders in the trenches at Bois Grenier, 1915. The foreground men hold both No.2 or 'Mexican' type long-handled stick grenades, and No.8 or No.9 'double cylinder emergency pattern' or 'jam tin' bombs; cf Plate B. Note the assorted headgear and lack of badges. On the brushwood-revetted trench wall hang sets of 1908 pattern webbing and a goatskin winter jerkin. At left, note a 'funk hole' dug into the parapet and curtained with a groundsheet. (IWM Q48958)

photographed carried by only two men in this manner, but it was easier to have extra hands when crossing rough ground. This crew from Infanterie-Regiment Nr 85 Herzog von Holstein basically wear the uniform of August 1914 with the slight variations which were becoming typical in spring 1915.

Their gun has the extra armour plates which were fitted to protect the front, top and sides of the water jacket, and the gunner, from bullets and shell splinters. In 1914 a memorandum by an Oberstleutnant Erdmann recommended that all 4,900-odd guns then on strength should be provided with these. As the war progressed a variety of different shields were encountered, but in 1914–16 the plates shown appear to have been the most usual set.

D1: This private wears the M1907/10 field-grey tunic with Brandenburg cuffs, red-piped stone-grey M1914 trousers, M1866 tan marching boots and M1895 belt. His M1895 *Pickelhaube* helmet has the regulation pre-war 'reed-green' field cover with red felt appliqué regimental number. All MG crews were issued with the P08 semi-automatic pistol as their personal weapon. At least two members of each crew wore leather drag straps with large leather-covered attachment rings at the ends. In a case on his belt he carries the gun's *Zielenrohr ZF12* optical sight.

D2: Wearing the field-grey M1910 *Feldmutze* field cap with red band and piping and national and Prussian cockades, this private carries two 250-round belts in each steel *Patronenkasten 11* ammunition box, and the issue wooden case for two spare barrels.

D3: The colour of *Pickelhaube* covers soon varied from reed-green through drab tan to drab grey; from August 1914 the numbers were ordered changed to green, and were sometimes painted rather than stitched. The light grey *Mantel* greatcoat bore plain red collar patches for all line infantry units.

D4: This senior rank is identified by the button on each side of his collar as a Gefreiter, approximating senior private or lance-corporal. Like D2, he wears the M1914 tunic of slightly simplified wartime manufacture, lacking the Brandenburg cuff detail; and he sports in his buttonhole the ribbon of the Iron Cross 2nd Class. Apart from his holstered P08 he also wears a frogged bayonet with a non-regulation reminder of pre-war service – a 'knot' in the blue and white colours of the regimental machine gun company. He carries the condensation tube and the carefully designed water can for the MG08

E: BRITISH 'BOMB CATAPULTS', 1915

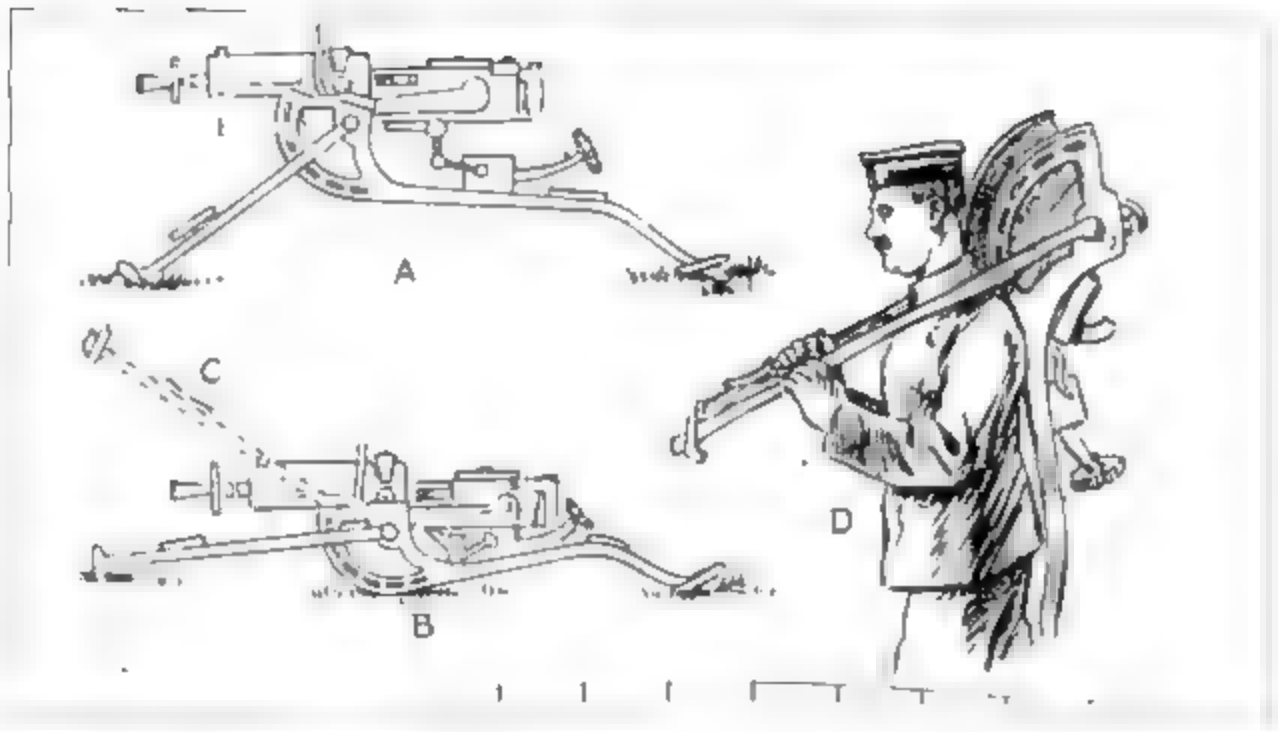
E1: Leach catapult; 7th Bn, Royal Sussex Regiment

Two Tommies from the 7th Royal Sussex prepare to loose a No.9 grenade from a Leach bomb thrower, issued on a scale of 20 per division in 1915. The Leach consisted of a wooden Y-shaped frame (sometimes with the triangular bracing plate shown here, sometimes without); the rubber ropes for the sling were pulled taut by a windlass system, with a wire cable running along the top and bottom of the wooden beam and engaging the sling with a hook. The corporal is about to use an entrenching tool helve to strike the hook's release trigger, while the private positions and lights the grenades. Note the goatskin jerkin and the M1914 trench caps typical of this period

E2: West spring gun, Coldstream Guards

The West was carried into place stretcher-fashion; then the four carrying handles were slid inwards in their brackets, and the iron catapult was bolted down to base boards. These were piled with sandbags to prevent it moving while it was cocked, by forcing the throwing arm back and down against the tension of the powerful spring 'battery' by means of a long dog-leg setting lever – this usually took the weight of three men to achieve. The setting lever was then removed, and replaced by a straight firing lever engaged with a bolt on the left side plate; downwards pressure released the mechanism. Alternative 'cups' were provided for taking different shapes of bomb – spherical, oval or cylindrical. This Coldstream Guards lance-sergeant, protected by his groundsheet and rubber trench waders, is about to deliver a spherical R Type No.21 grenade containing about 1lb (450g) of Amatol or Ammonal in a mild steel case, with a time fuze which was ignited automatically as it left the spring gun. The officer wears a privately purchased French steel helmet, and a raincoat. Although Macintosh had produced his famous waterproof rubberised fabric in the mid-19th century, it was the Great War which produced the 'trench coat'.

An officer of the King's Own demonstrates the latest headgear: the sniper's veil. Cf Plate C. (King's Own Collection, Lancaster City Museum)



Methods of positioning and shifting the heavy German MG08 – cf Plate D. (A) The sledge mount ready for action with the weapon low for a kneeling crew; (B) front legs adjusted for firing by a prone crew, or for dragging by prone crew with the straps provided, or for carrying stretcher-fashion; (C) leg adjustment for carrying the mount on the shoulders; (D) gun dismounted and mount carried by one man. Photographs show that a very strong man could even carry the mounted gun in this fashion, but it can hardly have been practical over any distance.

F: MINE WARFARE, VAUQUOIS SECTOR, MAY 1916

Some of the most intensive mine warfare of the Western Front took place in this sector, where French and German miners burrowed continuously under the lines, and counter-mined to blow in enemy works. Between September 1915 and August 1916 alone there were almost a hundred detonations. These ranged from minor diversions and spoiling attacks, to charges of thousands of kilos of high explosive which blasted huge craters in co-ordination with surface infantry and flame assaults. The German 50,000kg explosion of 14 May 1916 blew a crater more then 80m (262ft) in diameter

F1: French *camouflet*

The entrance to a small counter-mine on the 10eme Division front, where miners of Capt.Laigner's 5/1ere Compagnie are just coming off shift. They wear a mixture of old uniform items with pre-war linen drill/fatigue clothing, as seen in contemporary photographs. Note (left) the off-white fatigue blouse, corduroy trousers, gas goggles, and the Adnan helmet often worn below ground; and the improvised cage for canaries, which were taken underground to give early warning of poisonous fumes. The miner emerging from the steeply sloped entrance has a working hood made from a split sandbag, and the overtrousers of *bleu mecanicien* issued in 1914 to cover the M1897 red trousers; his comrade (right) wears the standard pre-war issue ticking shirt and knitted nightcap with linen fatigue trousers.

F2: German *Angreifer*

A major offensive mine being prepared by men of 30.Pionier-Batallion with infantry assistance. The tunnel is propped and braced, and its final section leading to the *Sprengkammer* or detonation chamber is lined with planking. Major underground works were supplied with both electric light (see cables and insulators), and fresh air via a pumped ventilation system (see large-bore pipe); field telephone cables (left) also provided communication with the working face. Small wooden or steel wagons running on 30cm gauge track were used for removing spoil and moving equipment forwards; here one of these *Minenhund* ('mine dogs') is being used to transport 2kg packs of explosives up to the chamber. Pioneers were distinguished by the black band of the technical branches on their field caps, though coloured bands were often hidden with a grey overband; the figure with the humcane lamp is a labourer seconded from the infantry. Again, the miners wear a mixture of uniform items and pre-war linen fatigue clothing, which was lighter and more easily cleaned. The NCO (right) carries a holstered P08 pistol, desperate underground encounters with the enemy were far from unknown.

G: ALLIED GASMASKS, 1915–16

G1: Barley mask, May 1915

This private of the 2nd Bn, Argyll & Sutherland Highlanders, from a famous photograph, wears anti-gas goggles and the pad respirator devised by Lt Barley of the Cameronians; the bottle contains 'hypo' solution for re-soaking the pads.

G2: Hypo helmet, summer 1915

From a photograph in the regimental collection of a lance-corporal of 1/5th Bn, The King's Own (Royal Lancaster Regiment) during gas practice out of the line, wearing his SD cap on top of the helmet. Made of impregnated flannel, and fitted with a small mica window, the hood (officially, 'Smoke Helmet') gave about three hours' protection. One or more were carried at all times in small drill cloth bags

G3: Harrison's Tower or Large Box Respirator, June 1916

From a photograph of an Australian chaplain at Fleurbaix; this new mask featured a face piece linked by a tube to a separate filter box carried in a haversack, and inspired the later 'Small Box Respirator'. It provided good protection over a prolonged time, and was mainly issued to artillery crews

G4: French P2 mask, October 1915

This soldier of the 171eme RI wears anti-gas goggles and the separate pad-type P2. Already obsolete by this date, French pad respirators were up-graded by the issue of extra colour-coded pads impregnated with different chemicals. The S2 stowage *sachet* was usually suspended from the belt, but sometimes buttoned or pinned to the uniform as here

G5: French M2 mask, summer 1916

This *tirailleur sénégalais* of Colonial troops in the Somme sector, wearing the yellow-braided *paletot colonial* peculiar to these units, has the snout-shaped M2 which entered service in April 1916. A multi-layered cloth bag with integral isinglass eye pieces, it was made in huge numbers, and later saw limited use by US forces. It was initially stowed in a cloth bag, later in this metal canister

G6: Russian Koumant-Zelinski respirator, 1916
Worn here by a *rayadol* (private) of the 84th Shirvanski Infantry Regiment, the Koumant-Zelinski made advanced use of rubber technology, having a full head piece which fitted tightly round the face. When not in use this was folded into an extension of the metal canister, and a circular, milled white metal plug was screwed into the bottom centre of the canister – the latter came in two models, this rectangular 'Petrograd' and an oval-section 'Moscow' model. Unfortunately this respirator was never available in anything like the numbers required, and many Russian troops were dependent on whatever masks could be spared by the other Allies

H: RUSSIAN TRENCH GARRISON, WINTER 1915–16

The first Russian Maxim machine guns were ordered from the factory in Kent, England, in 1889; a further order was placed in Germany. Thereafter the Russians produced their own M1905 and M1910 models; an example of the latter is shown here – note the side-mounted spool for the fabric 7.62mm ammunition belt, and the latter's brass spacers between every three rounds. The gun is mounted on an early Sokolov wheeled carriage, with folding legs allowing it to be fired over cover

H1: Gunner, infantry machine gun section
This soldier wears the standard M1907/10 khaki field service cap with green-painted leather visor and oval cockade in Romanov colours. His grey/brown M1881 greatcoat is fastened by hooks and eyes and has no visible buttons. He has his tent section slung over his shoulder, its ends tucked into the tinned copper cooking pot. At the outbreak of war there were two Maxim guns per battalion, each gun having a complement of one NCO, seven privates and two drivers. Men of these machine gun *'kommandos'* carried carbines or revolvers, and a dagger (*bebout*) instead of a bayonet. By regulation they were distinguished by a line of crimson braid around the top of the coat cuffs.

H2: Rifleman, 1st Siberian Rifle Regiment
All infantry units conscripted in Siberia were termed 'rifle' regiments; this soldier has the tall, shaggy fleece cap associated with that part of the Russian Empire, and his M1881 greatcoat has the crimson-piped dark green collar patches of this arm of service. The *bashlyk* cowl arranged around his shoulders could be worn as a hood or a scarf, the tape edging was applied in various colours, to unit or individual taste. His weapon is the 'three line' 7.62mm M1891 Moisin-Nagant rifle; the cruciform bayonet was always carried fixed when in the field. His belt supports 30-round M1893 pouches, and he carries additional ammunition in the canvas bandolier

H3: Telephonist NCO, Signals Company, 7th Engineer Battalion
This sergeant's technical branch of service is identified by the scarlet-piped black collar patches on his greatcoat, his NCO status by the silver buttons on them, his unit by the brown stencils – entwined lightnings and '7' – on his shoulder straps, and his rank by the three white lace stripes across them. He is armed with the M1895 Nagant 7.62mm revolver; and note that by regulation full medals were to be worn even in combat. In 1914 the Russians had 50 'telegraph companies', from which were drawn signallers for the field armies. Each four-battalion infantry regiment was supplied with just nine field telephones and 7.5 miles of wire. In all Great War armies the lack of wireless communications had devastating results: telephone land lines were routinely broken by shellfire or accident, leaving commanders in battle dependent on flags, flares, runners or carrier pigeons for monitoring the changing situation and passing orders accordingly. This inability to react to events in an informed way caused enormous casualties which would otherwise have been avoidable

I: GERMAN TRENCH RAIDERS, RIR Nr.110; THE SOMME, APRIL 1916

Following a mine explosion, bombardment and gas shelling, five officers and 50 men of Reserve-Infanterie-Regiment Nr.110, led by Hauptmann Wagener, launched a raid on the trenches of the Royal Irish Rifles at La Boiselle on the evening of 11 April 1916. The British were distracted by thick smoke,

British officers in Gallipoli with a selection of trench warfare equipment. The object at centre is a Gamages (Leach) catapult – cf Plate E1. In the foreground left and right are two small trench mortars; and at centre an SMLE is mounted on a locally manufactured 'hyposcope', or set-down stock, to allow shooting over the parapet without exposing the firer. The officer on the left has a Hale type rodded rifle grenade just visible in the muzzle of his SMLE.

A Saxon infantryman throwing stick grenades, 1915; the bombs are of the early pattern with round-ended handles. One of his sets of triple ammunition pouches has been left off so that two extra grenades can be hooked to the belt. Cf Plate I.

trench mortar fire, and the showing of dummies in another part of the line. This allowed three parties under Leutnants Stradtmann, Boening and Dumas to enter a trench named 'the Spion'. In the ensuing mêlée with grenades, bayonets and pistols 29 British were captured and a greater number claimed killed; booty included a Lewis gun, one sniper's and 20 other rifles, plus assorted equipment. The raiders had only one man wounded.

I1: Leutnant, group leader

This junior officer, wearing an old M1910 *Waffenrock* tunic with enlisted men's field-grey trousers and puttees, reloads his C96 Mauser 7.63mm 'broom handle' semi-automatic pistol; note the wooden holster which doubled as a clip-on shoulder stock. According to Wagener's orders, gas masks were to be slung and 'tucked into the tunic'; this is the M1915 *Gummimaske*, with a rubberised fabric face piece and a separate, replacable screw-on filter canister. He also ordered the display of a field sign, 'a triangle of white linen sewn on the breast and back'. The headgear is a knitted woollen toque.

I2: Private, grenadier

He wears his M1915 *Pickelhaube* with the spike removed in the field, and a drab cover without markings as per regulations of late 1915. The M1907/10 tunic, with unit shoulder straps removed for security, is worn with brown corduroy trousers. He is armed with a P08 pistol, and his entrenching tool is probably sharpened for use as a hatchet in hand-to-hand combat; note also the long-handled wire cutters. He is pulling the friction igniter cord of an M1916 *Stielhandgranate*, and has others in a 'waterwings'-shaped carrier improvised from two sandbags. He is wearing his M1915 gasmask; at the start of the attack gas blew back over the raiders, causing Leutnant Stradtmann to vomit and temporarily incapacitating another man. Leutnant Erb, the regimental adjutant, liaised with the forward parties wearing full oxygen breathing apparatus.

I3: NCO, support group

Despite the disguising effect of the toque and 'lamp black' facial camouflage, his NCO status is marked by the L-sections of dull silver braid worn on the edges of the collar of his M1914 tunic. This is just visible above the gathered closure of the tent section, which he wears here rigged as a cape; this could also be used to carry back booty. He is armed with the standard G98 rifle and fixed bayonet, and a trench knife; note also the flare signal pistol thrust into his belt. Unteroffizier Nössler was one of several NCOs who distinguished themselves in hand-to-hand fighting during this raid.

J: FRENCH INFANTRY WITH TRENCH MORTAR; VERDUN, 1916

J1: Soldat de 1ere classe, marching order

The M1914 'horizon-blue' uniform adopted for low visibility from spring 1915 was by now universal among Metropolitan troops; the exact shades of different items varied considerably, however. For the troops all insignia applied to it were now dark blue: the regimental numbers and edge-piping on the collar patches, short rank bars on the cuffs, and – as here – a small chevron on the upper right sleeve for each wound suffered. During 1915 the serious incidence of head wounds led both the French and British to introduce steel 'shrapnel helmets' as general issue; these gave varying protection against splinters and shrapnel balls, but would not stop a rifle bullet at most ranges. The mild steel M1915 Adrian model, lighter than that of other armies, was ordered worn with a drawstring cover for a few months in early 1916; these were seen in both khaki hessian and, less often, in light blue cloth.

Heavy personal backpacks were nothing new to the French infantryman, but his load became bulkier as the war progressed due to the extra munitions and subsistence equipment needed in the trenches. This soldier, arriving in the front lines up a typical 'corduroy' track, carries about 25–30kg (55–66lbs), including a canvas knapsack externally stowed with his tent section and pegs, spare boots, and a hatchet and collapsible canvas bucket from among his squad's field gear. The marching pack was no longer carried into battle; by 1916 anything that did not fit in the *poilu's* three-pouch belt order was carried in a tent cloth 'horseshoe roll', extra *musettes* and two-litre M1877 canteens, or in his pockets – the greatcoat received two large reinforced side pockets for extra ammunition late in 1915 (see J3). His weapon is the 8mm Berthier rifle which supplemented the supply of Lebels from 1915.

J2: Mortar man, 66eme Régiment d'Infanterie

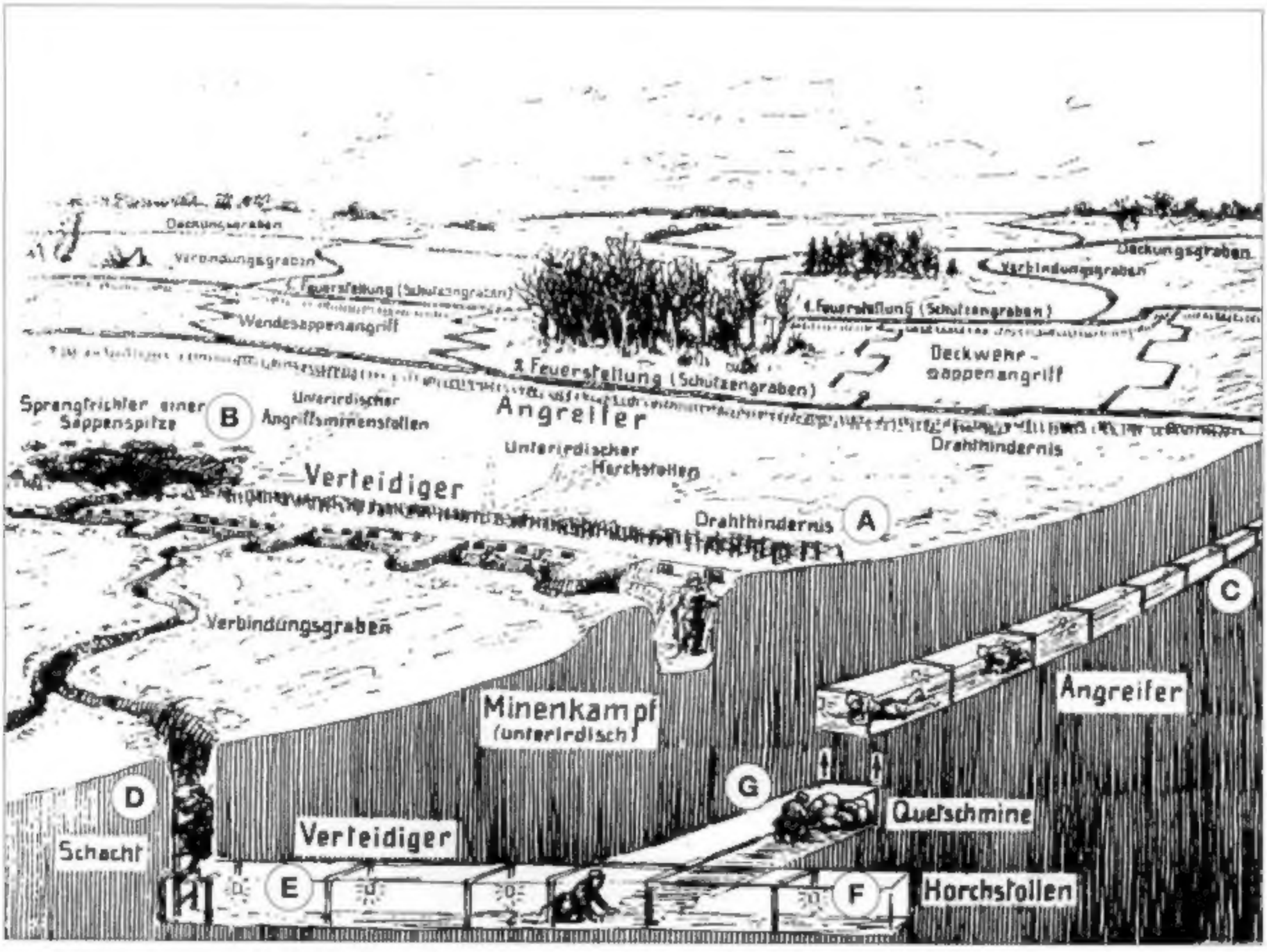
This regiment from the Tours region was fed into the line at

Verdun in May. The tunic of the M1914 horizon-blue uniform was seldom worn uncovered in the front line; except in hot weather most French infantry retained the greatcoat which had been their fighting uniform for generations. The trousers retained the yellow piping of early 1915 even after the yellow collar patches were abandoned. Note the sidecap or *bonnet de police* which was re-introduced to replace the *képi* as the infantryman's out-of-the-line headgear in 1915; and the traditional bright blue cravat worn with the collarless shirt of ticking material. The 58mm trench mortar, which he is adjusting during a quiet spell behind the first line positions, fired a 6kg (13.2lb) impact-detonated projectile out to about 500 yards; its tail was placed inside the barrel, leaving its widely spaced fins outside. A typically casual dump of unfuzed bombs is seen in the background.

J3: Gas sentry, 25eme Régiment d'Infanterie

The two chevrons on this veteran's upper left sleeve show that he has served in the 'Zone of the Armies' for at least 18 months; the first of these 'sardines', introduced in April 1916, marked a year's service, and each subsequent chevron a further six months. Waiting to bang his shell case alarm gong at the first whiff of gas, this sentry has dumped most of his equipment apart from his M2 gasmask in its tin canister; but his static vigil is made safer from the attentions of snipers by wearing Diagre type steel body armour, described as covered with grey/blue canvas. Note also the curved armour plates – *epauliers Adrian* – covered in old coat cloth and sewn to the shoulders of his M1915 single-breasted greatcoat. Although remarkably few survive, no fewer than 3.2 million of these were issued to units between February and August 1916. Among those photographed using them were the 25eme RI, and also the 132eme on the Fort Vaux sector at Verdun in June 1916. Note that the usual cloth rolls, to stop equipment straps slipping off the shoulders, were attached to the top of this armour.

Diagram of mine warfare – cf Plate F; in fact the mines were usually much deeper than this, often 60–80ft (20–25m) below ground. We are looking across No Man's Land from behind the French front line (A); at (B) is an old mine crater now incorporated into the defences. (C) is a German offensive mine being dug under the French trenches; the gallery is shown here unrealistically small – see Plate F2. (D) is a vertical shaft dug down from a communications trench behind the French front line, from which a transverse gallery (E) has been developed, with a listening post (F). This has detected the German working; a *camouflet* (G) defensive mine has been dug forward under the suspected position of the German gallery, with an explosive charge which will be set off to destroy it. Opposing teams of tunnellers sometimes broke into each others' works underground, leading to nightmarish hand-to-hand battles with small arms and grenades.



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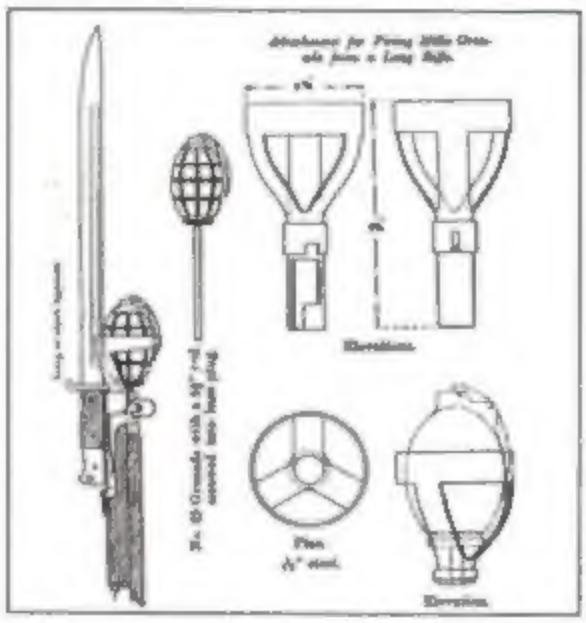

Diagrams

Photographs

World War I Trench Warfare (1) 1914–16

The regular armies which marched off to war in 1914 were composed of massed riflemen, screened by cavalry and supported by artillery; their leaders expected a quick and decisive outcome, achieved by sweeping manoeuvre, bold leadership and skill at arms. Eighteen months later the whole nature of field armies and their tactics had changed utterly. In sophisticated trench systems forming a battlefield a few miles wide and 400 miles long, conscript armies sheltered from massive long-range bombardment, wielding new weapons according to new tactical doctrines. This first of two richly illustrated studies explains in detail the specifics of that extraordinary transformation.

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